NOVEMBER 30, 1959

American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING

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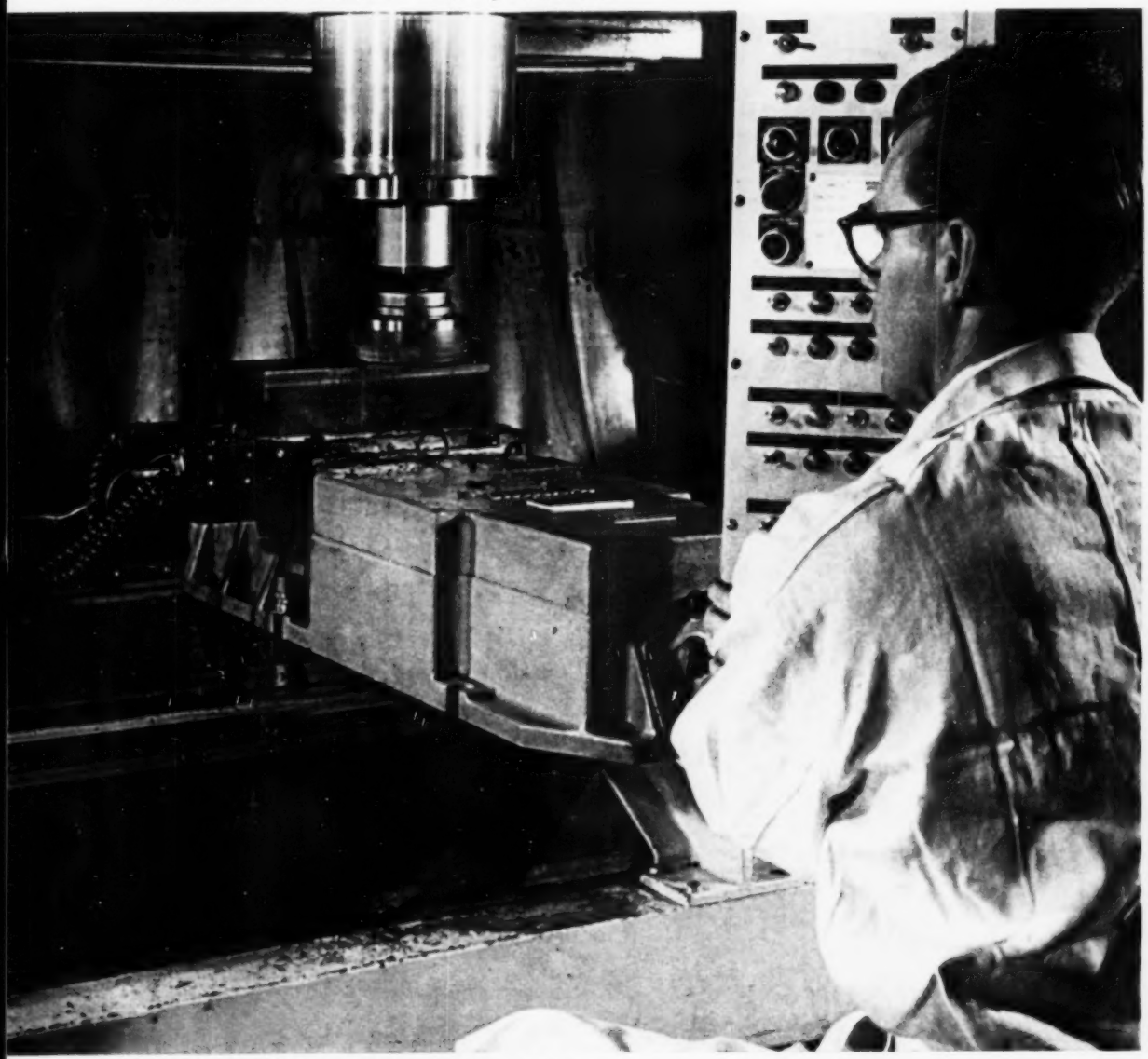

North American Aviation mills AM-355 at 800 F

HOT MACHINING and FORMING

page 88 page 90

if you surface grind small work

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on the HEALD MODEL 161 ROTARY

WHEN you want to get a better finish, easier and at *lower cost*, put your small surface grinding work on a Heald Model 161 Rotary. Available with a standard 6" chuck and 8" auxiliary top plate, it will handle work with a swing of up to 12½" inside the guard. On long runs or short, it will give you the high precision and fine surface finish that you'd expect only from a larger and much more costly machine.

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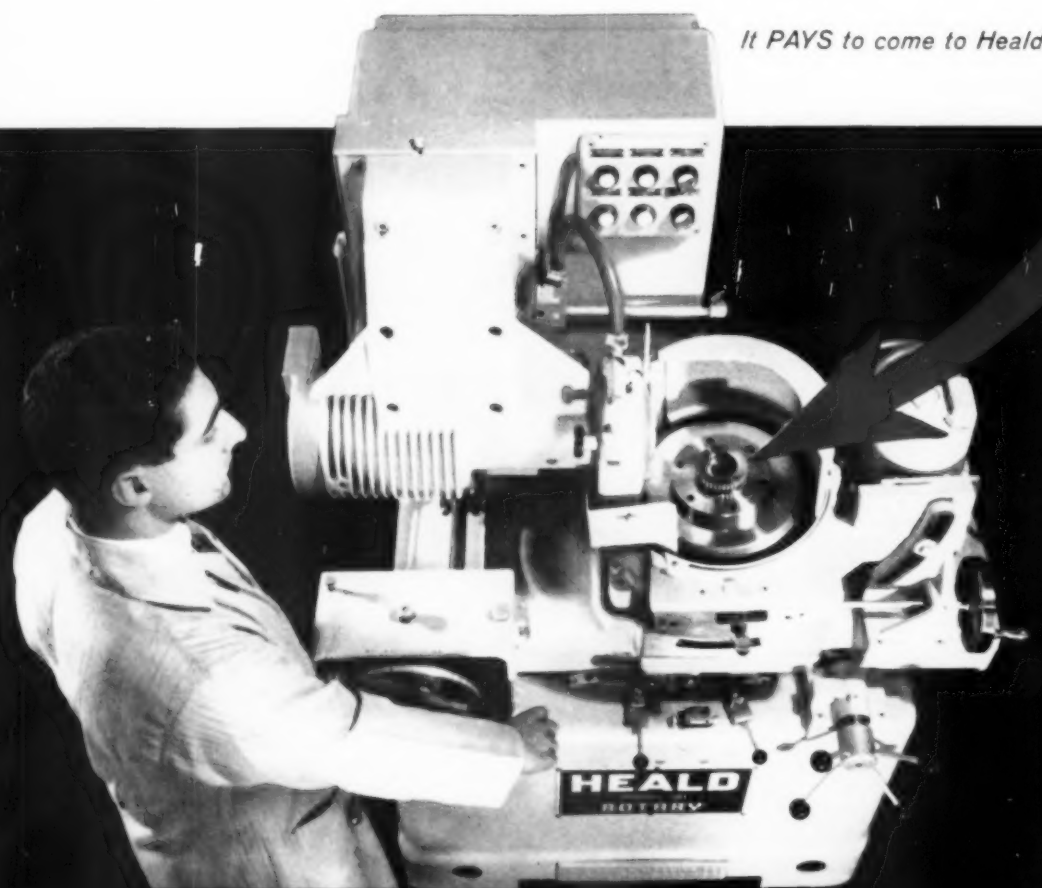

HEALD

COVER:

Sundstrand milling machine with zirconium facing on Airlox vise jaws is used for hot machining at North American Aviation. Details on page 88.

American Machinist

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METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Coupled Feed

A feed rate that is directly coupled to table speed and can be infinitely varied *while the tool is cutting* will be incorporated in a new line of vertical turret lathes that Bullard will introduce next year. The feed control reads directly in inches per revolution so that the actual feed produced varies with the settings of table speed.

Because the action of chipbreakers will vary with feed rate it is possible to adjust feed to produce the desired form of chip. It is also possible to adjust feed rate to suit changes in stock-removal requirements or to compensate for tool wear.

Separate feed controls will be provided for each of the heads on the machine. At the same time traverse of each head is controlled by a single lever. A pistol grip is turned so the arrow on the grip points in the direction of traverse desired, then speed of traverse is directly proportional to the amount of movement of the lever. When tools are engaged feed is started with this same lever. In the larger sizes, the single-lever control will be replaced by a push-button pendant.

"Torque-Shear" Cutoff

"Cutoff" of bars from 60,000 to 250,000+ psi tensile strength is practically as simple as snapping a bar of hard candy with a French machine soon to be introduced here. Now in use in England and Europe, the machine is said to shear the hardest metals, including Nimonic up to four inches in diameter, in a fraction of a second. Pieces are separated to extremely close tolerances and without kerf losses. Cutoff is accomplished by a hydraulically powered torque-shearing effect. The bar is clamped in two adjacent plates with the point of desired cleavage at the interface between the plates. With one plate stationary, the other plate is given a simultaneous rotating and downward-shearing motion which "snaps" off the required length of metal. The inventors say that pieces as short as one-third the bar diameter can be separated and that there is no damage to the metal's structure. However, they caution that the technique becomes less satisfactory in direct proportion to the ductility of the material. Most popular use so far is cutoff of billets.

Sensing Toolslide

Rotor laminations for electric motors may be stacked ± one lamination before welding. Problem: to chamfer the ends of the rotor equally.

During machining, one end of the rotor will rest against a locating surface, and the chamfering tool will always perform as desired. To avoid a variable chamfer on the other end, Baird Machine Co., Bridgeport, developed a special slide with a sensing device. This slide incorporates a locator that contacts the upper end of the rotor. When contact is made, the slide is locked, and the tool is fed to produce a chamfer of the desired width.

Lamination stacks are ¾ to 2¾ in. high, for various motors produced in the General Purpose Motor Plant, General Electric Co., Decatur, Ind. Size of the work prompted Baird Machine Co to develop a larger series of 4-spindle, continuously rotating, vertical turret lathes. Known as the 84 VC, the machine takes work up to 8 in. dia and is large enough to incorporate dovetail slides. These permit a wide variety of attachments, including the sensing slide mentioned. Indexable, throwaway carbide tools are used in the GE installation, which is saving $9,000 per yr, as compared to the three single-spindle lathes formerly used.

Hot-Machining Tests

Size of the workpiece may influence the effectiveness of hot machining, according to test results at North American Aviation. Small parts in the new high-strength, high-temperature alloys such as H-11 and AM 355 can be cut at many times the usual metal-removal rate. But larger parts, where the teeth of the cutter are in more constant contact with the hot work, may require ambient-temperature machining because the tool edges wear rapidly. For more details, including the best carbide for hot machining, see p88.

Progress in Small Holes

High-frequency spindles with mechanical axial vibration drill tiny holes in jewels, drawing dies, nozzles, and other parts in a line of 30 machines developed by Mechanique & Plastique, Geneva, Switzerland. Spindle speeds of 60,000 to 80,000 rpm are maintained for drills as small as 0.002 in., which are retained in plastic-coated brass cones. Work-handling is simplified with a mechanical feeder and automatic chuck. The unit also releases a drop of abrasive mixture on the part. Brass cone and drill are connected only by the plastic material.

FORMING

Missile Forgings

Astroloy, a high-temperature alloy, has been forged successfully for the first time by Wyman-Gordon at its North Grafton, Mass, plant. Large forgings of all-beta titanium are another achievement.

Sufficient development work has now been done on forging of Astroloy to enable Wyman-Gordon to guarantee minimum properties in closed-die forgings to 40-in. dia. Already exhibited is a turbine wheel

weighing 170 lb and measuring 26 in. in dia.

For the parts for which Astroloy can be used, the operating temperatures of missiles and jet engines can be increased 200 F. This gain means increased power and greater payloads.

All-beta titanium, a metal containing vanadium, chromium, and aluminum, is being forged to a 180,000-200,000-psi yield strength with 4-6% elongation. On a strength-to-density basis, the forged titanium alloy is equal to steel with 290,000-psi yield strength. Potential exists for even greater strengths in the forged B120VCA alloy, leading to the belief that missile engineers will be able to take advantage of the higher burst strengths available.

Hot Stretch Forming

Titanium is stretch-formed at temperatures up to 1200 F by a new technique that operates with a stainless-steel die. Low-voltage current at a high rate is passed through the die, which is a piece of stainless 0.09 in. thick, and is secured to a Compreg base. The die is formed in a normal Compreg die, then normalized. Thus the work is formed against a die composed of thin metal that is actually a duplicate of the final work shape. Normal operating temperature is usually 800 F for the die, 700 F for the work. For further details, see p90.

HEAT TREATING

High-Temperature Refractory

A light, porous, alumina brick refractory capable of withstanding furnace temperatures up to 3400 F is being developed by Ipsen Industries, Inc, Rockford, Ill, probably for use in new high-temperature carburizing furnaces. Used as a furnace lining, the new brick eliminates the need for expensive metal muffles, thereby permitting the furnace to be operated at higher temperatures and higher heating rates.

For an earlier report on alumina brick furnace linings, see *AM*—Jun 1 '59, p2.

INSPECTION

Typed Measurements

A new method for inspecting and recording gage-block accuracies is in use by Webber Gage Co., Cleveland. The electronic equipment eliminates human error in calibration of gage blocks. Also, gage blocks sent in for inspection can be returned to owners in a short time.

The equipment was furnished by the Cleveland Instrument Co. A high-precision electronic comparator measures the blocks to one millionth of an International Inch. Gage-block size is shown visually by a digital voltmeter, which also sends impulses to an electric typewriter. The typewriter then automatically records the correct sizes on the Webber certificate. Any deviation from marked size is shown to the 6th decimal place, to "flag" any block that is too worn.

The digital voltmeter can cover a wide range and eliminates meter error. On the usual instrument scale, the span may be limited to ± 20 millionths. But with the digital voltmeter, the span might be as high as ± 0.001 and still one could read to one millionth. The typewriter need not be used on many applications where a digital voltmeter will serve, although it will of course provide a record, and also the means for analyzing errors from nominal settings.

INSPECTION

Photos of Honeycomb

Structural integrity of brazed honeycomb sections is being checked by a photo - fluorography technique. Complete inspection is carried out progressively by a technique developed by Picker X-Ray Corp.

Elements of the system are: an X-ray tube; a 16 x 16 in. fine-grain fluorescent screen with light-tight hood; a sharp-focusing, fast camera, and 100-ft rolls of 70-mm film that provide 400 exposures per reel, at 2½ cents per exposure.

X-ray head and detector move across the honeycomb section to scan the entire unit, exposing 16 x 16 in. sections in sequence. Each projection on the fluorescent screen is automatically recorded by the camera. Exposed film is processed in an automatic machine.

During a scanning period, the operator has little to do with the inspection under way, which takes less than one hour for a 10 x 20-ft panel. He processes the exposed film and views it on the projection screen. However, the operator can control film travel, and even stop it to examine questionable detail as long as desired.

ASSEMBLY

Multiple Brazing Dips

Assemblies can be returned to a brazing molten-salt bath as many as four times to add successive parts, and without fixtures. The technique is applied by John Gombos Co, Clifton, N J, on radar units made with chassis parts of high-temperature aluminum alloy. Parts are joined by self-tapping screws, whose heads are later removed to leave a smooth surface. The threads fill in with braze metal. Seams previously brazed are brushed with wetted braze powder before the final dip to make sure the joints are filled. Brazing alloy is inserted between joining pieces in the form of shims or rings. This produces gas-tight assemblies. Only major critical factor is to make sure subassemblies are joined in proper rotation.

FINISHING

Chemical Polishing

A method of obtaining a high polish on copper and aluminum alloys is now in wide use in Europe. Process consists of dipping the cleaned work in a bath of hot solution based on phosphoric acid for periods of one to three min. On some materials, no preliminary mechanical polishing is required, and parts may be chemically treated, washed, dried, and lacquered or plated, as required. On other materials, preliminary polishing may be needed to remove small surface defects, followed by a 30-sec dip in the solution.

Several British and German automobile manufacturers are using the process for finishing trim, and report substantial savings, particularly on parts of complex shape difficult to polish mechanically. Decorative finishes can be obtained on

THE OUTLOOK

Steel mills are trying to bring as divergent a product mix into supply as possible—and they are trying to see that as many different customers as possible get it, even though there are some "hardship priorities" (autos for instance). But metalworking production will continue to drop well into 1960. (see p81).

METALWORKING REPORT . . .

aluminum by chemical polishing, anodizing, and dyeing.

Other solutions are being developed for polishing steel but, while these have worked satisfactorily in the laboratory, they are not yet ready for commercial application because they are inherently unstable and have too short a service life.

MATERIALS HANDLING

Die Handling Looks Up

Overhead die handling is now standard procedure at the Convair-Astronautics plant in San Diego, Calif. A gantry crane, monorail, and conveyors have replaced conventional die trucks. Results: plant aisles can be narrower, die-storage smaller, and plant layout is improved.

In the die yard, the gantry crane lifts a die (as heavy as 16 tons) and transfers it to the monorail, which carries it to the proper machine. Here the die is lowered to a transfer skate mounted on entrance tracks that lead into the press. Now the die moves directly into the press.

MATERIALS & COMPONENTS

Low-Temp Silicone Varnish

A new low-temperature curing silicone impregnating varnish which develops outstanding electrical properties at 150 C has been announced by General Electric Company's Silicone Products Dept. Identified as SR-220, this silicone varnish cures at temperatures formerly used only for organic coatings. In addition to low-temperature cure, SR-220 also offers superior heat life, excellent shelf life, and tank stability for manufacturers of transformers and electronics equipment, according to its developers. This material eliminates the need for high-temperature curing ovens and permits the use of existing organic varnish curing facilities. It will not damage organic insulating compounds. Thus, by applying a coating of this new silicone over existing insulation systems, it is possible to obtain improved temperature and heat-life capabilities.

MANUFACTURING CONTROL

Cable Safety Fence

To bring the spindle of its big new 8-in. horizontal bore-drill-mill machine down to floorplate level, the West Allis (Wisc) plant of Allis-Chalmers had to put the machine ways in an 8-ft-deep pit. The safety hazard that arose was eliminated by a novel double-cable fence that runs along the edge of the floorplate.

The two cables, anchored at each end of the 44-ft-long pit, thread vertically through pulleys on brackets bolted to the machine base. Thus the cables pass under the machine base as the machine traverses the ways, so the spindle has clearance. At the same time the cables, 42 and 22 in. high, provide a safety fence everywhere else along the ways.

Trip bars connected to limit switches eliminate pinch hazards at each of the pulley-support brackets, so that an operator can't be caught between the machine and the workpiece as the machine column moves longitudinally. The limit switches trip both feed and traverse.

Blueprint Reproducer

Great savings in space and time are possible with the "photo-flow" camera recently installed at General Motors AC Spark Plug Div in Milwaukee. The photographic equipment, which can reduce prints up to 700 ft long by a ratio of up to 6-to-1, has also saved the Engineering Dept $6000 in paper costs alone after two months of operation.

The flow camera scans, or flows, across the blueprint, taking pictures through a series of internal lenses and mirrors. Because the negative is run through the blueprint maker, the original drawing is spared considerable wear.

Processing of photographs is automatic. A drawing from the print room is inserted into the camera (which has a 350-ft roll of film). When all the film footage is expired, the roll goes into a processing machine that automatically develops, stops, fixes, and washes the film. It comes out of the processor dried and ready for use.

Maximum width of the film is 21 in. Because of the ratio of reduction, original copy six times the maximum film dimensions can be photographed.

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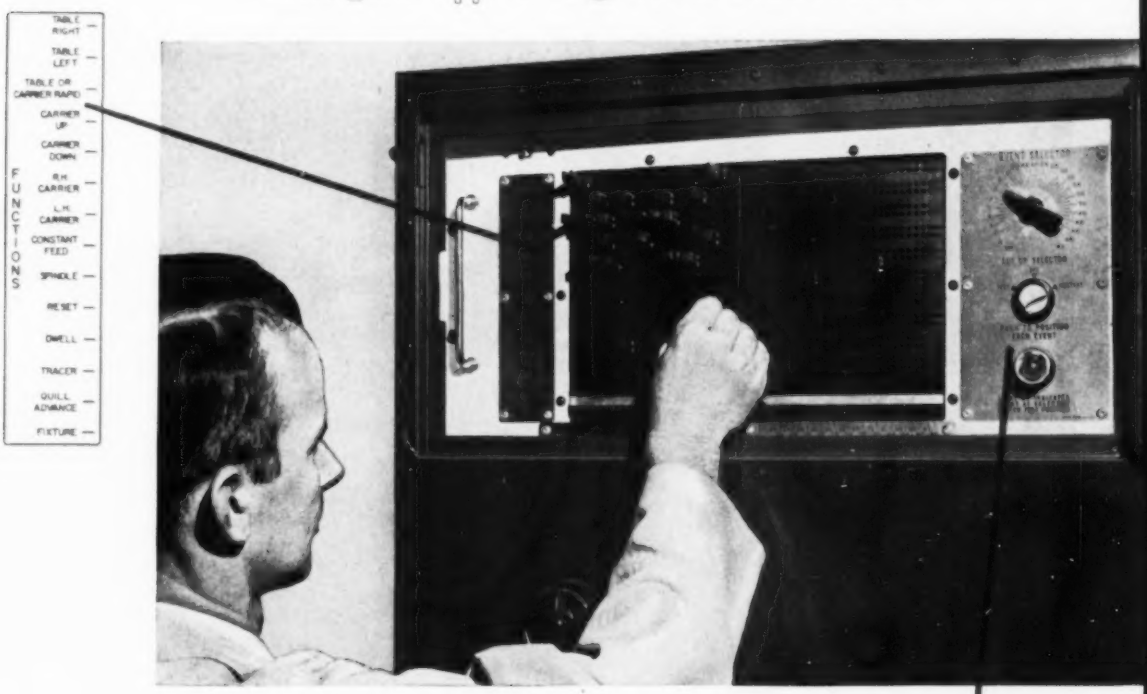
CINCINNATI

New Cincinnati Telematic Control

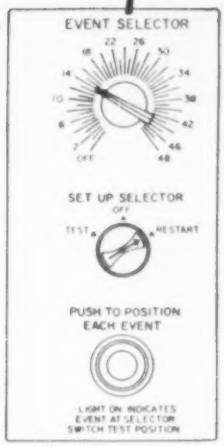
Programs Automatic Milling Cycles through Simple Plug-in Selections



Cost advantages of automatic cycle milling now are available for smaller lots than ever before. New CINCINNATI Telematic Control is the answer. This new type of control is simple to use and versatile beyond imagination.

The operator programs all automatic functions of the cycle by merely inserting plugs in a panel board. If desired, a mask can be made for repeat jobs, exposing only the necessary holes. In addition to controlling all functions or movements of the machine table and spindle carrier, Telematic provides for auxiliary operations such as fixture clamping or indexing. A row of 24 holes opposite each machine function allows the operator to plug in complex automatic cycles involving up to 24 events. Additional panels, like the two-unit illustrated, can be supplied.

Telematic is the newest, most versatile and simplest of the operator controlled programming methods. Turn the page and see how it is applied to the new CINCINNATI 100 and 200 Series HyPowermatic Milling Machines. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**



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• CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI
MILLING MACHINE DIVISION

CINCINNATI MILLING MACHINE DIVISION'S ...*New* 100

AUTOMATICALLY MILLING TWO DIFFERENT PARTS to demonstrate the complex milling cycle (see drawing) which can be programmed on a 200 Series Tracer Controlled Hy-Powermatic, merely by inserting plugs in the Telematic panel board.

CINCINNATI

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES •

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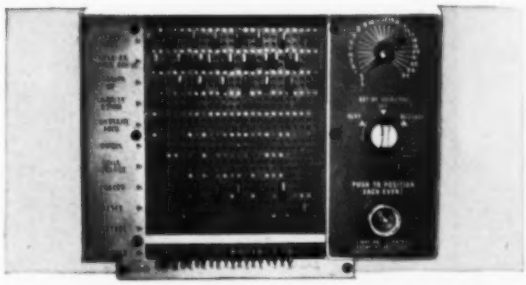
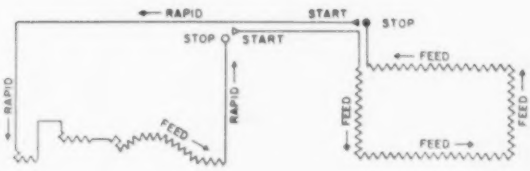
and 200 series HyPowermatics

add new versatility to automatic cycle milling



COMPLETE PROGRAM for automatic milling cycles is set up by plugging in the various events on the Telematic control panel. A 24-event board is illustrated above. Automatic cycle diagram for setup on facing page is shown below.

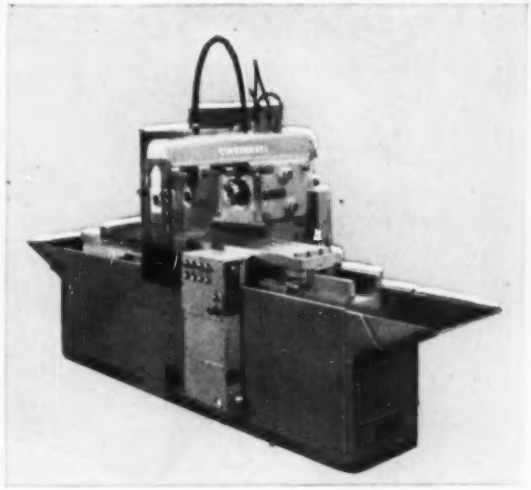


Good news for job shop and production shop managers. The new CINCINNATI 100 and 200 Series HyPowermatic Milling Machines have the flexibility for both short runs and production runs. They push older machines into the high-cost category.

These new HyPowermatics incorporate several exclusive feature-advantages, while retaining the rapid metal cutting characteristics of the heavier members of the line. Hydramech table drive, a Cincinnati big-machine feature, automatically eliminates backlash and assures smooth metal cutting for up-milling or down-milling, feeding right or left. Bed ways are square gibbed, flame hardened and automatically lubricated. Chips and cutting fluid are channeled into compartments at the ends of the bed, keeping the working area clean.

Telematic control is standard equipment for programming automatic milling cycles on Automatic Rise-and-Fall and Tracer-Controlled HyPowermatics. These styles are also equipped with a variable speed hydraulic motor for vertical positioning and feeding of the spindle carrier. The unit feeds both up and down.

New CINCINNATI 100 and 200 Series HyPowermatic Milling Machines (7½ and 10 hp respectively) are built in plain and duplex styles, and three types of spindle carrier: 1) conventional, 2) automatic rise-and-fall, 3) tracer controlled. May we tell you more about them?



New CINCINNATI 100 Series HyPowermatic Milling Machine with 36" table travel. Ask for complete information today.

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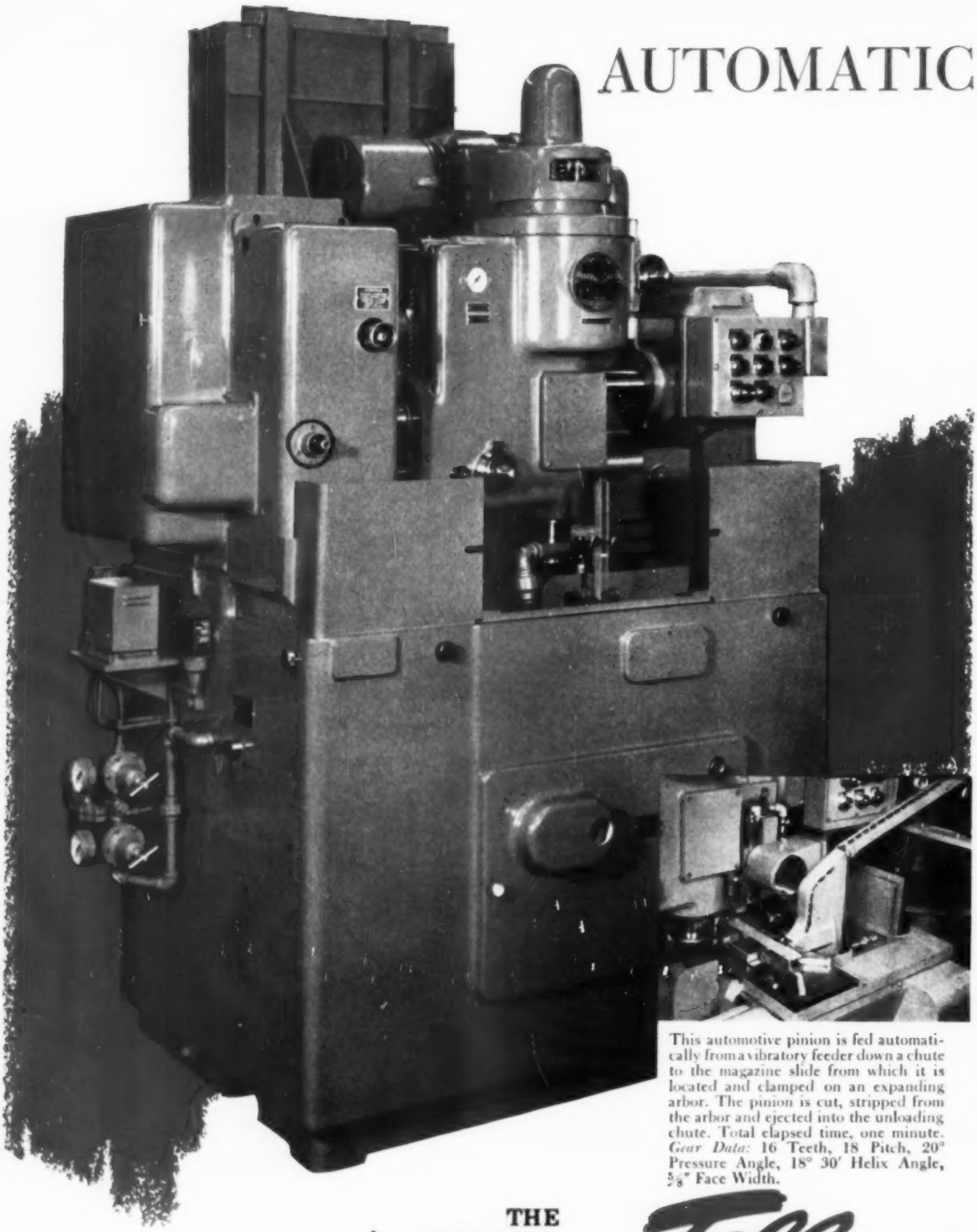


This automotive pinion is fed automatically from a vibratory feeder down a chute to the magazine slide from which it is located and clamped on an expanding arbor. The pinion is cut, stripped from the arbor and ejected into the unloading chute. Total elapsed time, one minute. *Gear Data:* 16 Teeth, 18 Pitch, 20° Pressure Angle, 18° 30′ Helix Angle, 5/8" Face Width.

THE PRECISION LINE

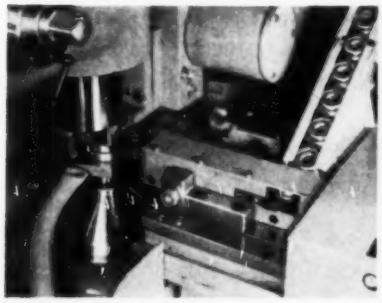
Fellows

WORK HANDLING
Is A Natural Complement to the High Production Rates of the Fellows 4GS Gear Shaper

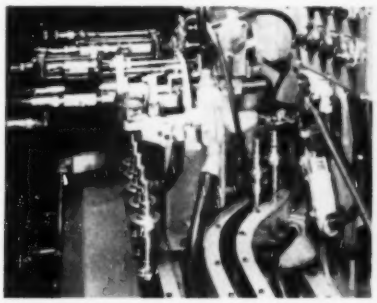
Although designed for both manual and automatic loading, the 4GS Fellows Gear Shaper makes best use of its high production rates when equipped with work handling devices.

The physical construction of the machine is such that it may be easily adapted for use with magazines and chutes for automatic loading and unloading at substantial cost savings on continuous production runs.

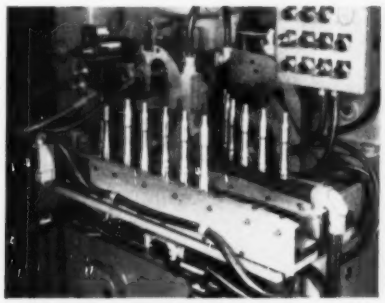
Ask your Fellows representative about the many advantages of automatic work handling with the 4GS Fellows Gear Shaper, or write direct to the Fellows Gear Shaper Company.



These internal clutch parts are handled in the same manner as the 16-tooth external pinion, except that the cutter-spindle is automatically stopped at the top of its stroke for clearance during the loading and unloading cycle. Cutting time is 1½ minutes. *Gear Data:* 10 Teeth, 12.4 Pitch (Stubbed), 30° Pressure Angle, Spur, 5/32" Face Width.



This transmission cluster gear shaft is handled by two sets of air-operated "fingers" mounted on a turret. As the turret rotates, one set of fingers moves the finished piece to the unloading chute while the other set brings the new blank into position. Cutting time is 35 seconds. *Gear Data:* 10 Teeth, 12.4 Pitch (Stubbed), 30° Pressure Angle, External Spur, 5/32" Face Width.



This automotive stem pinion is handled in the same manner as the cluster gear. In both cases, safety devices prevent the machine from starting unless the blanks are in the correct cutting position. Loading and unloading chutes may be hand or conveyor fed. Cutting time is 2½ minutes. *Gear Data:* 17 Teeth, 10 Pitch, 19° 30′ Pressure Angle, 32° 51′ Helix Angle, 5/8" Face Width.

Gear Production Equipment

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont, U. S. A.
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Exceptional Tool Life

This excellent performance is another example of how LANDIS equipment and knowledge solves threading problems the most economical and efficient way.

. . . threading at fast production rate

A LANDEX Hardened and Ground Die Head threads 5000 pipe plugs between chaser grinds at the rate of 800 per hour at the Safety Socket Screw Company, Chicago, Illinois, manufacturers of "Blue Devil" socket screw products.

3/8" 18 pitch N.P.T. threads were cut on 4140 annealed steel (15-20 Rockwell "C"). Threading was performed at approximately 27 surface feet per minute by a 7/8" LLL LANDEX Head on a tapping machine.

This high production and excellent chaser life is the result of over 50 years experience by the LANDIS MACHINE COMPANY in the development and exclusive manufacture of threading equipment. For example, in the area of chaser design, chasers are given special hardening when workpiece design or material specifications so indicate. A LANDEX Hardened and Ground head was used in this application because of the inherent qualities of hardened and ground construction to enable long life, trouble free operation and the rigidity necessary for maximum thread cutting accuracy. The LANDEX Head is a revolving die head unmatched for precision threading and true economy for application to automatic screw machines and other types of machines employing a live spindle.

LANDEX Heads are available in four sizes that will thread diameters from No. 4 to 1 1/4" and 1/8" to 3/4" pipe. Let us show you the type and size head that will offer you precision threading and true economy. Send specifications and ask for Bulletin F-80-7.

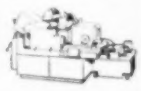
LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines

Die Heads — Rotary & Stationary

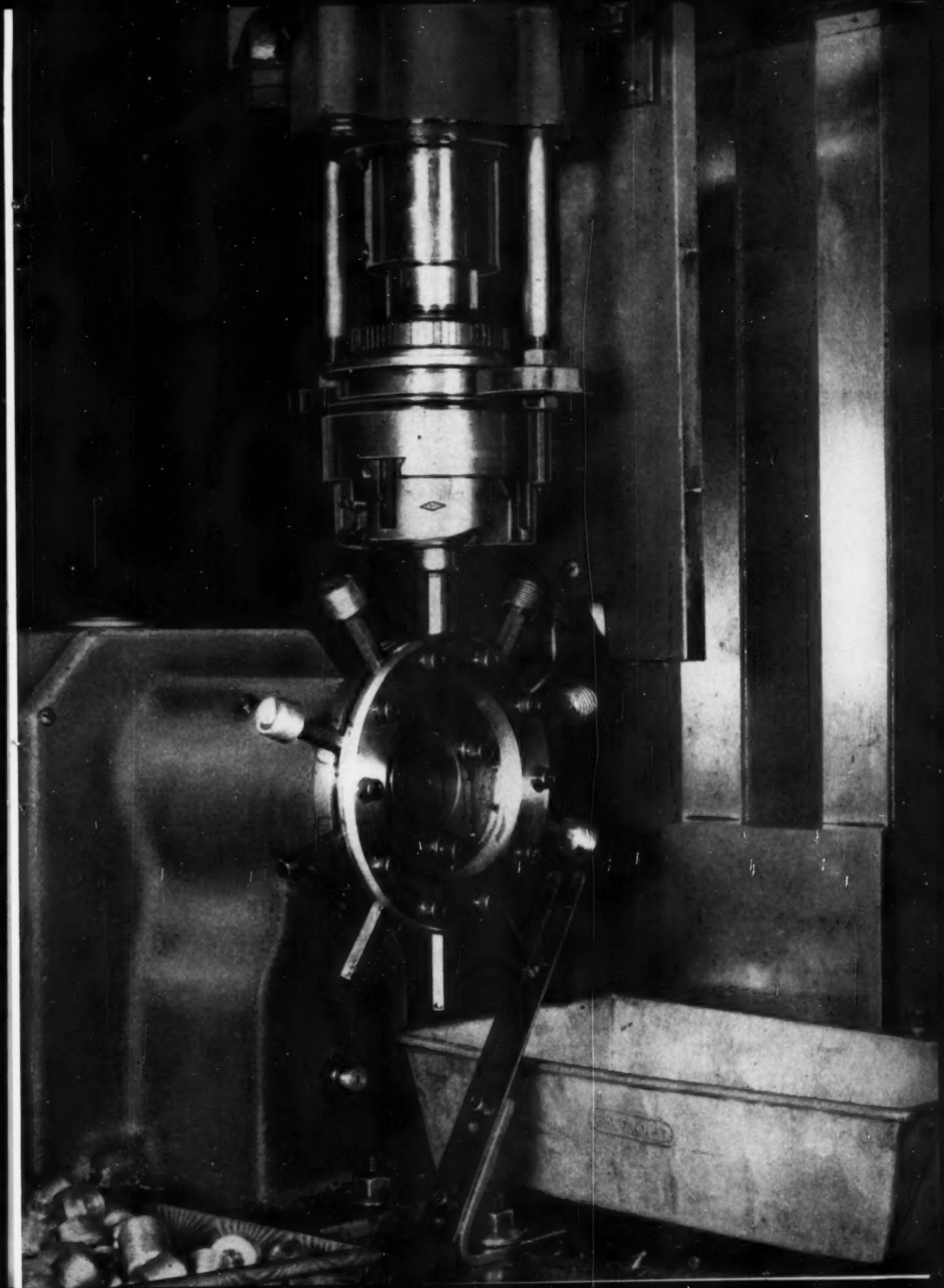
Taps — Collapsible & Solid Adjustable


Centerless Thread Grinding Machines

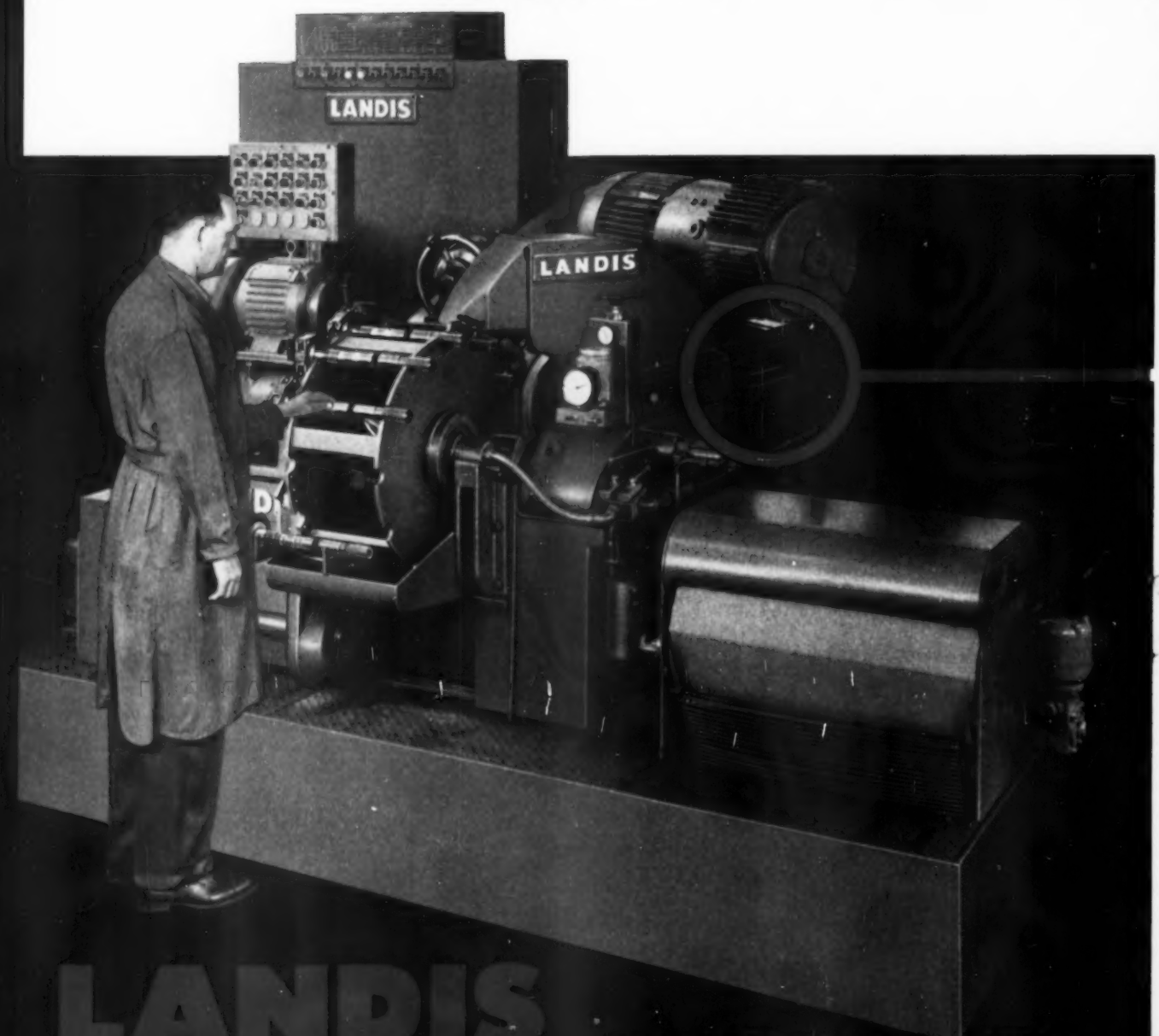
Thread Rolling Tools

Thread Rolling Machines

529C



new Landis truform dresser maintains closer



LANDIS

precision grinders

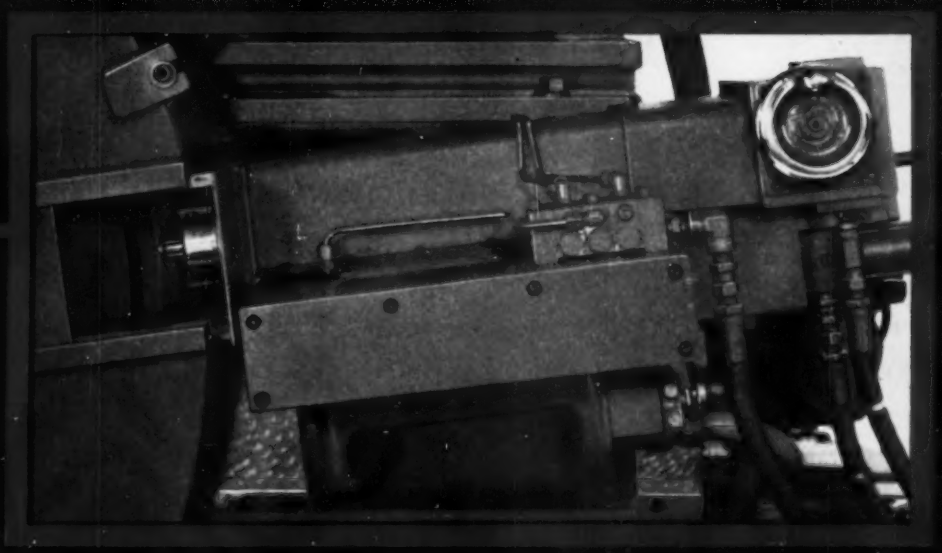
New Landis R Plunge Grinder with new TRUFORM dresser, automatically grinding 3 diameters and face of transmission shaft in one operation.

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

improves accuracy, tolerances

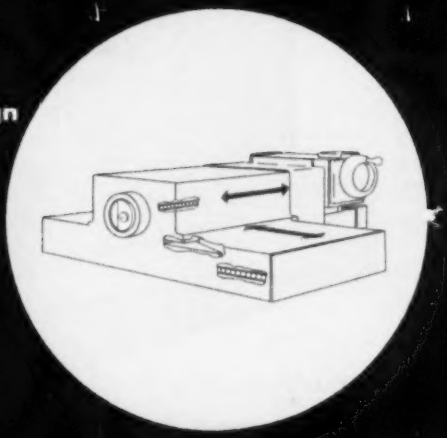
TRUFORM DRESSER is an exclusive Landis development with these special advantages:

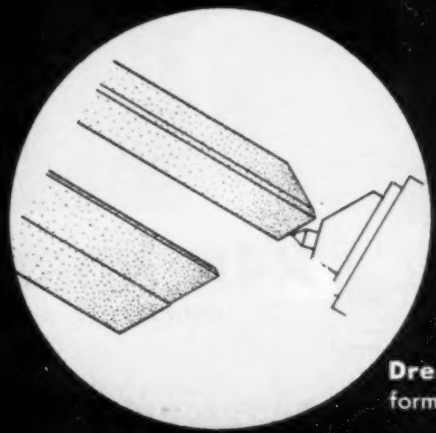
- preloaded ball slide with no shake gives more accurate dressing
- dresses in either direction up to 60° angles
- pushbutton control assures uniform dressing cycles
- built-in accuracy cuts dressing time—saves on diamond costs
- automatic lubrication for continuing accuracy



Exceptional accuracy and stability always assure exact duplication of the profile to the wheel.

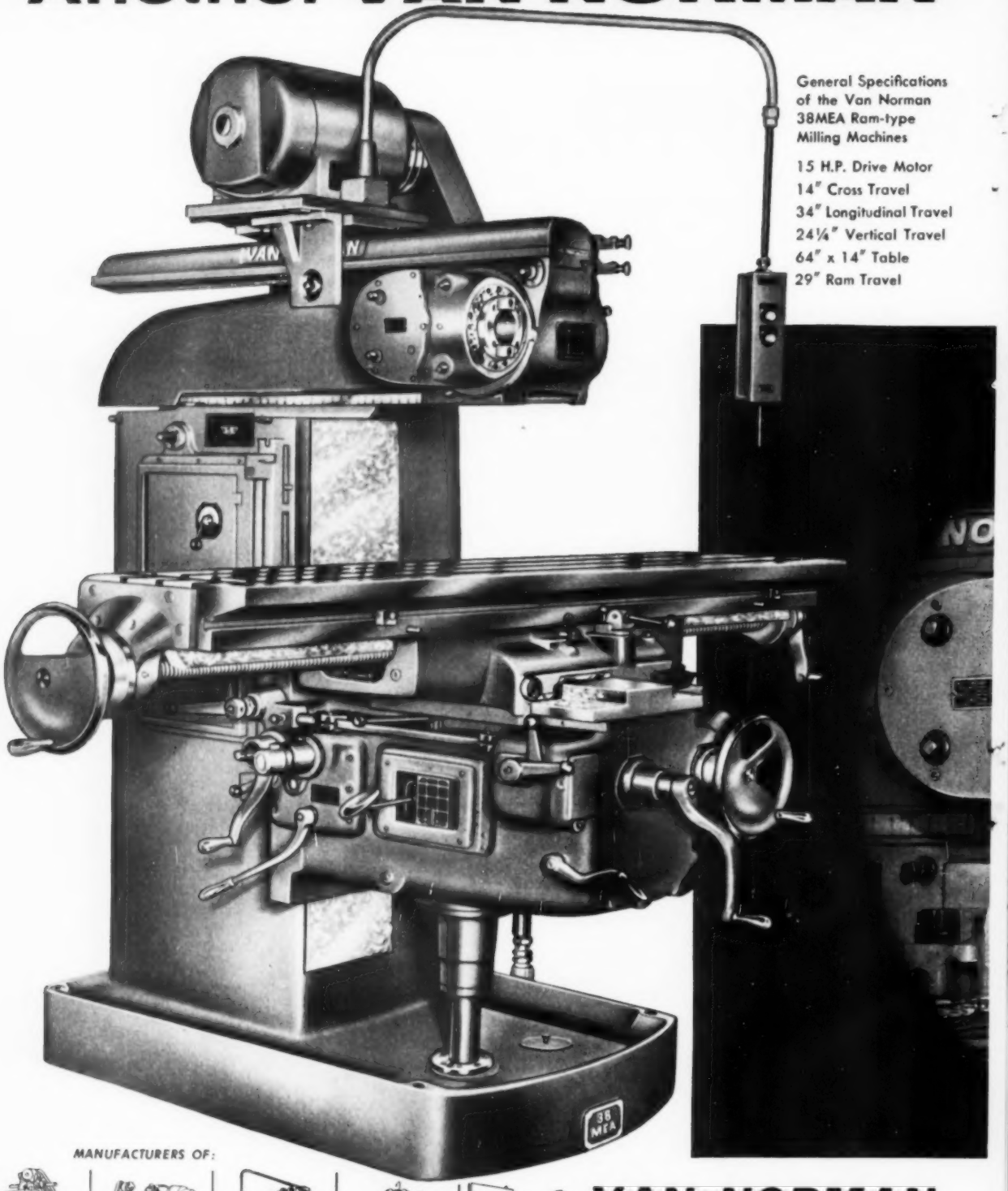
New pre-loaded ball-slide design eliminates shake for accurate dressing.





Dresses a Profile of 60°—new dressing efficiency forms wheel profiles not possible before.

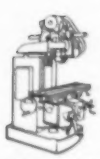
Another VAN NORMAN



General Specifications
of the Van Norman
38MEA Ram-type
Milling Machines

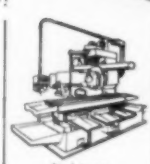
15 H.P. Drive Motor
14" Cross Travel
34" Longitudinal Travel
24¼" Vertical Travel
64" x 14" Table
29" Ram Travel

MANUFACTURERS OF:

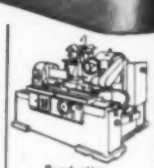


Milling Machines

Standard Cylindrical Grinders



Bed-type Mills



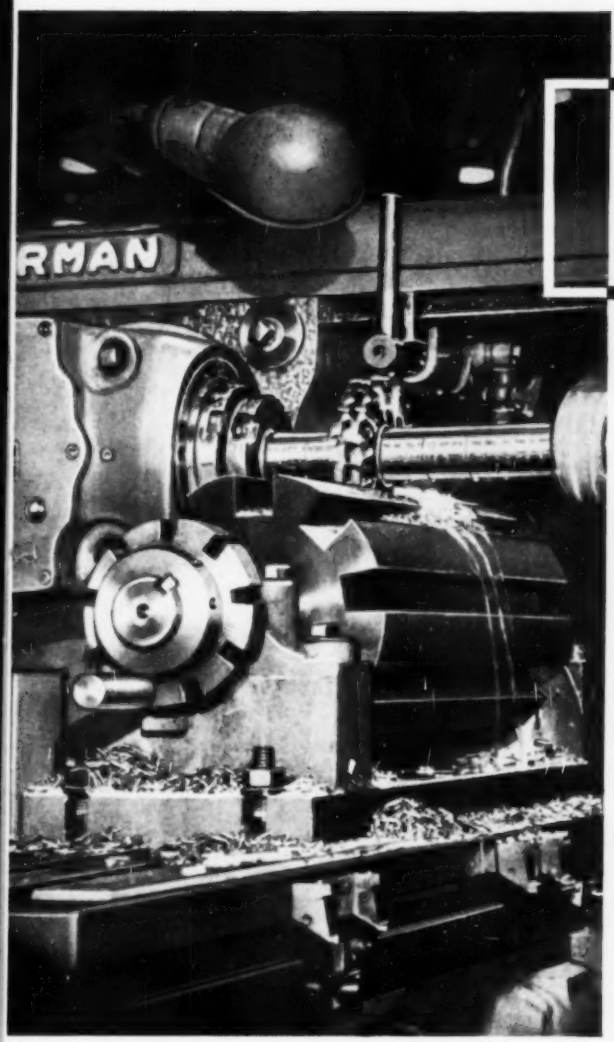
Production Grinders

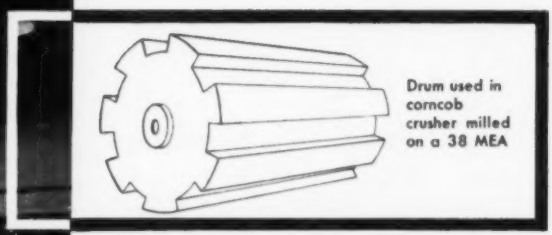
Centerless Grinders

VAN NORMAN

SPRINGFIELD 7, MASSACHUSETTS

Cost Saving Application
Featuring a
VAN NORMAN Ram-type Mill





Drum used in corncob crusher milled on a 38 MEA

Versatile, new Van Norman milling machines are today being used for a wide variety of precision milling operations by all forms of industry. One reason for the growing popularity of these production mills is the increased size of the column, ram and table, giving them greater range and versatility than ever before.

Here's but one example how a Van Norman ram-type mill is economically solving a production milling problem:

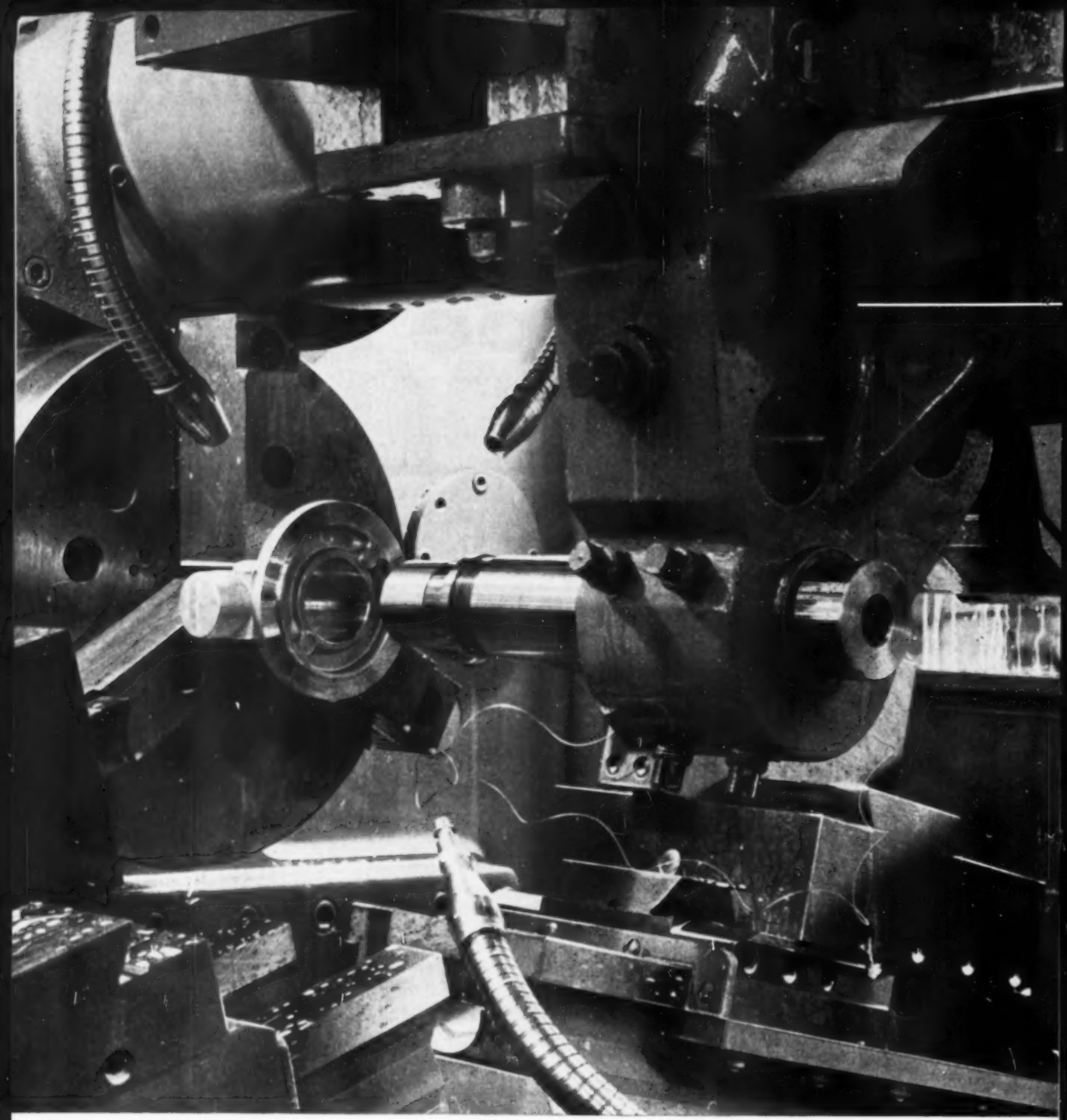
Equipped with a special indexing fixture, a Van Norman 38MEA easily mills 12 slots the length of a drum used in a corncob crusher. It mills one 1½" wide x 1¼" deep slot at a time, using two staggered milling cutters. The material being milled is 1045 steel. This large workpiece is easily handled on a standard machine having a 24¼" vertical feed and a 14" cross feed.

This is a typical illustration of the many milling jobs being done today with large capacity, heavy-duty Van Norman mills. The oversize column, ram and table mean that standard Van Norman mills can be adapted to many jobs that normally would require two or more milling machines of a larger size.

Investigate this versatile Van Norman mill today. Write for a complete catalog.

MACHINE COMPANY
A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED

Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.



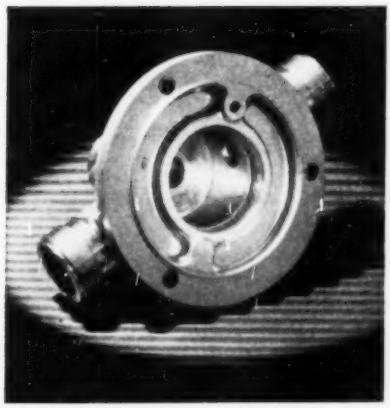
Story behind the story —Installation of an extra switch operating screw in the index drum for "Spindle Stop on Turret Return" and elimination of a speed dog on the bushing assembly station permit the bushing to be inserted automatically. With the spindle stopped, the loading tool comes forward in rapid traverse and presses the bushing home automatically. The simple, yet unique, bushing assembly bar, designed by Thompson's tool engineers, utilizes stacked "Belleville" washers to present sufficient end pressure to seat the bushing—while, at the same time, offering a cushion between final seating of the bushing and the end of the pentagon turret's forward stroke. It assures proper seating of the bushing in addition to providing a safety factor to the turret's operating mechanism.

At Thompson Ramo Wooldridge Inc.

THOMPSON PRODUCTS ELECTRONICS DIVISION

Warner & Swasey 2 AC cuts production time two-thirds on this coaxial switch housing

Repetitive accuracy and versatility of their new 2 AC Single Spindle Chucking Automatic enabled the consolidation of three separate operations, with their required setups and part handlings, into only one setup—reducing overall time from 21 to 7 hours per hundred parts, machined in lots averaging 400 pieces.



This finish-machined aluminum forging will eventually house a coaxial switch used in jet bomber countermeasure systems.

Prior to putting this aluminum housing job on their 2 AC, Thompson's Electronics Division at Cleveland had to perform the following separate operations:

1. **Drill, finish bore and face mounting flange on a No. 3 hand turret lathe.**
2. **Press bronze bushing into bore on an arbor press; and,**
3. **Finish-machine bushing bore to a total tolerance of .001 inch on a No. 3 hand turret lathe.**

Now, their 2 AC Chucker handles the complete job cycle.

Most important factor that made this changeover possible was the 2 AC's repetitive accuracy. A press fit tolerance of .001 to .003-inch had to be maintained—which meant that the 1.735-inch diameter bore had to be held within ±.0005-inch consistently on piece after piece. This posed no problem for the 2 AC.

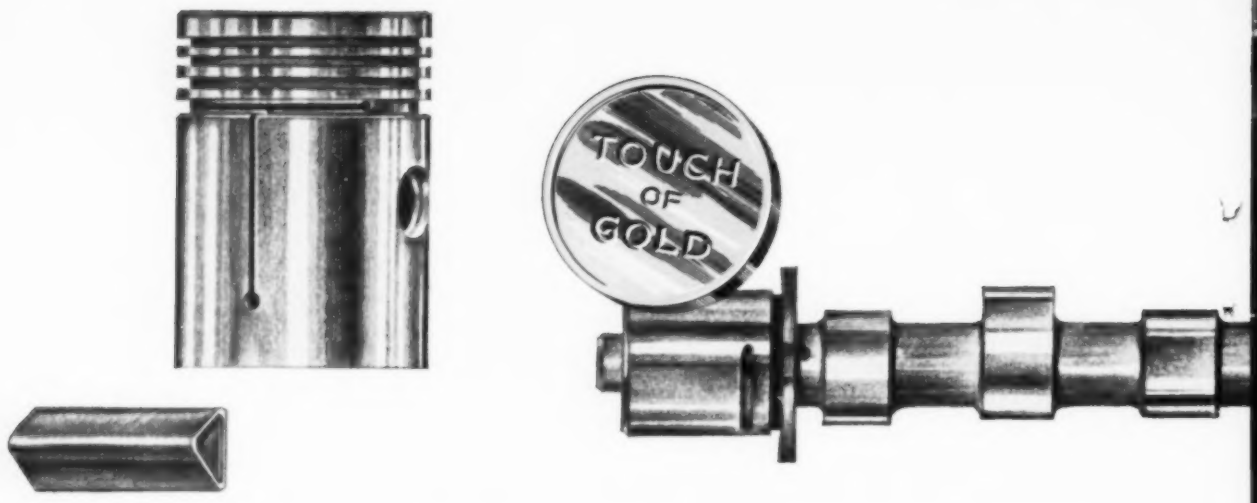
Unique "self-contained" design features of the 2 AC—overhead pentagon turret supported by only two wide, and widely-spaced, bearings in the same housing with the spindle—more than met the job's accuracy demand. This unusual concept eliminates the cumulative tolerance problem of multiple bearing turret locating designs. Without this accuracy, automatic assembly would be a hazardous undertaking—could result in both high scrap loss and a damaged machine.

Talk today with your nearest Warner & Swasey Field Representative. Let him show how these versatile Single Spindle Chucking Automatics can materially reduce your production time—increase overall profits.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS

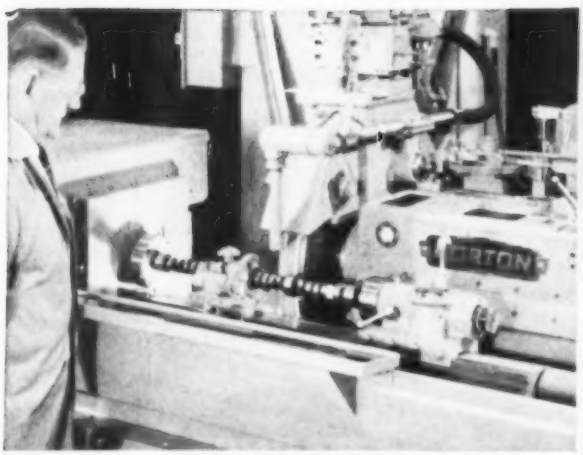
...WITH A WARNER & SWASEY

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

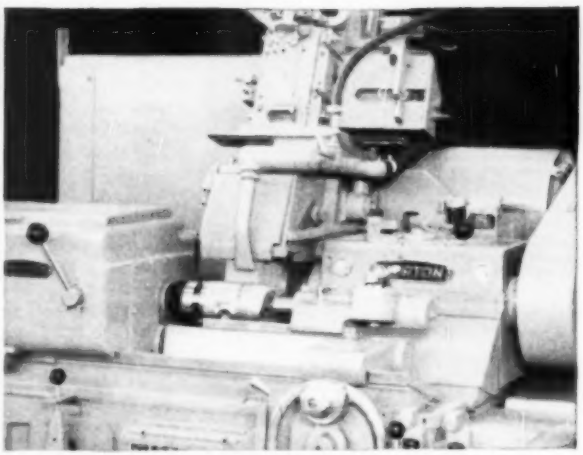


If you grind
special shapes . . . like these

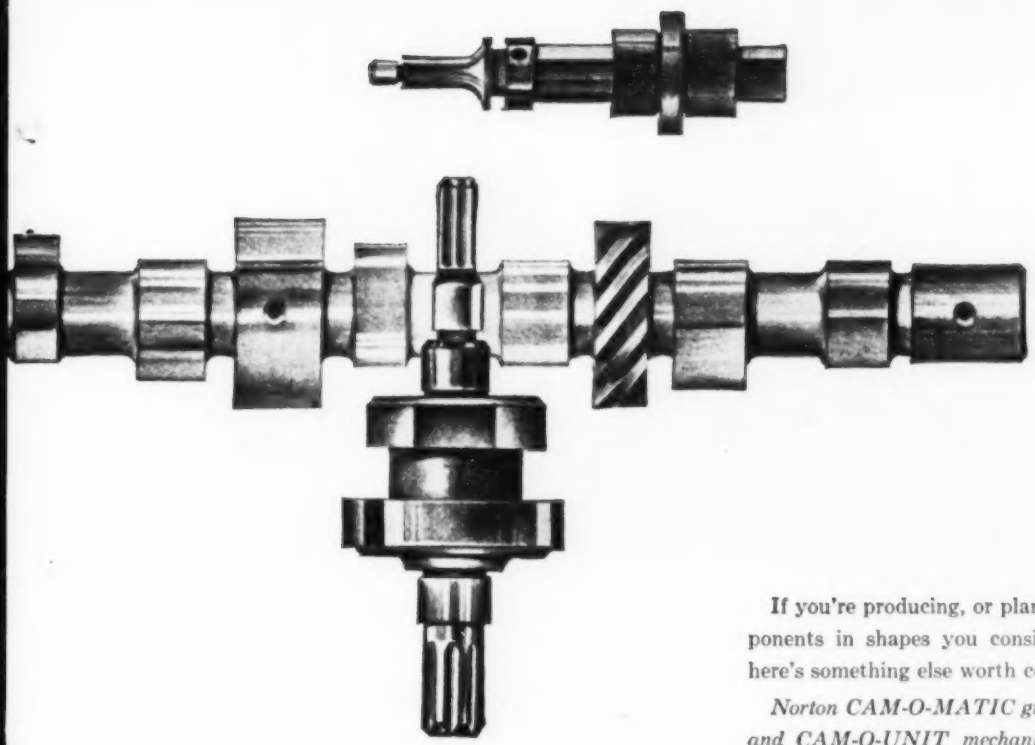
Check the special advantages of Norton grinders . . .



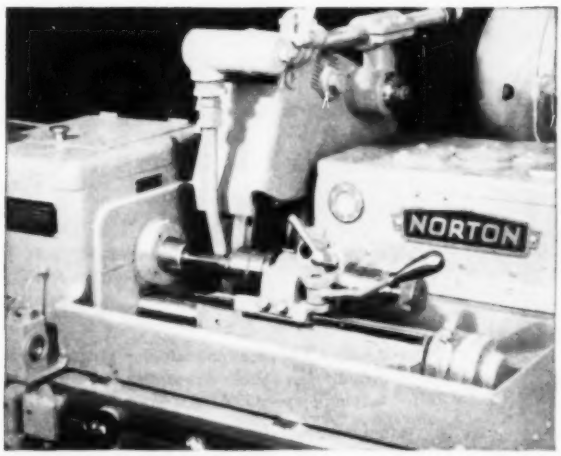
With a Norton No. 3 CAM-O-MATIC® Grinder, you grind all cams and the eccentric on an automotive-type camshaft automatically, in one handling. Automatic wheel truing and a patented device for grinding cam tapers in one or both directions are among the features that improve contour, finish and production rate.



A Norton 6" x 8" Semiautomatic Piston Grinder adds extra speed and economy to your grinding of elliptical pistons. Mechanism arrangements enable you to grind complex ovality into the skirt of a piston, as shown, or to produce standard ovality or different amounts of relief over a wide range.



. . like these



Norton CAM-O-UNIT® Mechanisms, made in varying work capacities, are particularly valuable for extending the proved advantages of Norton CTU cylindrical grinders to the grinding of cams, elliptical pistons and many other forms. The CAM-O-UNIT mechanism shown is attached to a 6" CTU to grind the three faces of a carbide tool bit.

If you're producing, or planning to produce, components in shapes you consider difficult to grind, here's something else worth considering.

Norton CAM-O-MATIC grinders, piston grinders and CAM-O-UNIT mechanisms are engineered to handle a wide range of cam and shape grinding . . . including endless variations of square, triangular, oval and many-sided forms . . . and to provide the exact forms and tolerances you need with fast, trouble-free performance that will lower your operating costs.

Shapes you can produce on this special grinding equipment include not only arcs but curves and tangent flats in combination. Your Norton Man, a trained grinding engineer, will be glad to give you expert help in selecting and operating grinding equipment that will bring you top-quality, low-cost results on the toughest jobs. NORTON Company, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. *In Canada:* J. H. Ryder Machinery Co., Limited, Toronto 5.

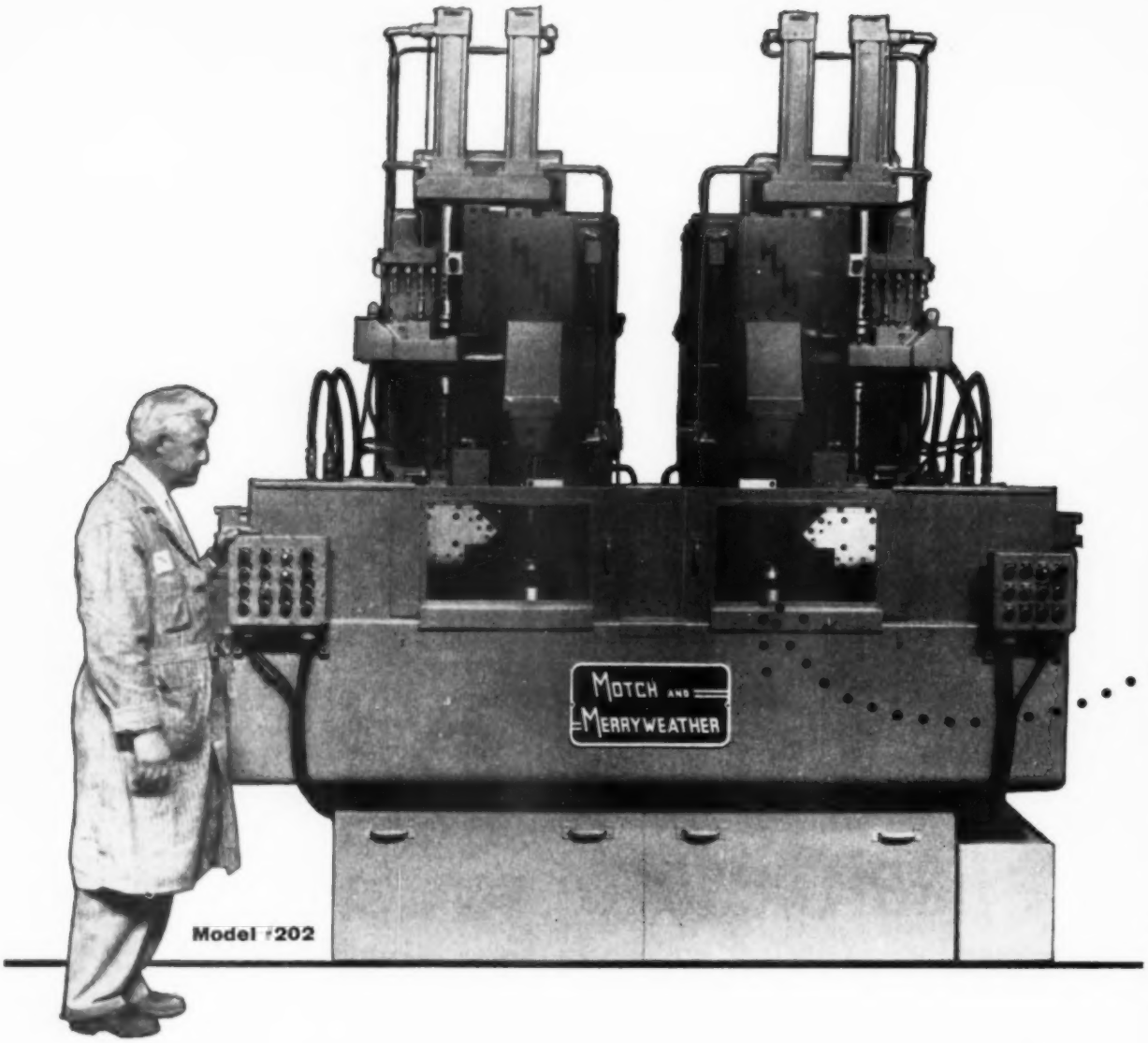
®Trade Marks Reg. U.S. Pat. Off. and Foreign Countries

NORTON

GRINDERS *and* LAPPERS

Making better products
...to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — **BEAN-MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

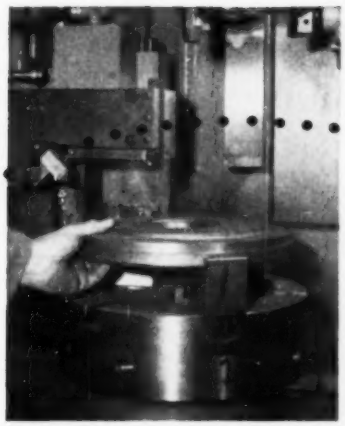


MOTCH & MERRYWEATHER'S

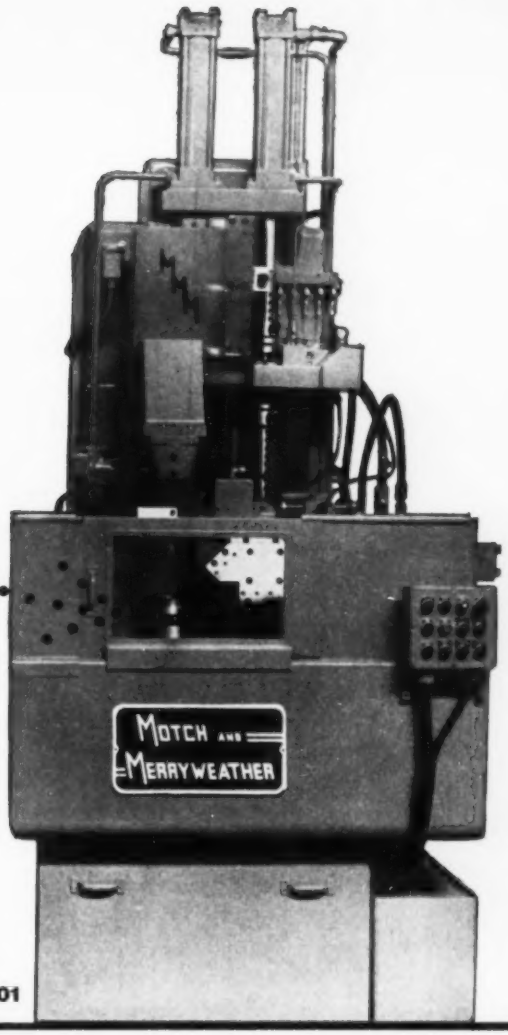
...add flexibility to standard machining operations

Here's a machine tool designed for precision turning, boring and facing operations with versatility for long and short run production jobs. Features:

- **spindles will accommodate any type chuck including air operated draw bar (20" swing) —spindle speeds adjustable.**
- **automatically-lubricated tool slides.**
- **slide ways of hardened and ground steel with tapered gibs for accurate alignment and easy adjustment.**
- **hardened adjustable slide stops.**
- **hydraulic or cam-actuated slide-feed, rapid traverse and rapid return.**



Boring, facing, and turning—to 20"—is accurately handled on the new M&M Series #200 Vertical Turners.



Model #201

#200 VERTICAL TURNERS

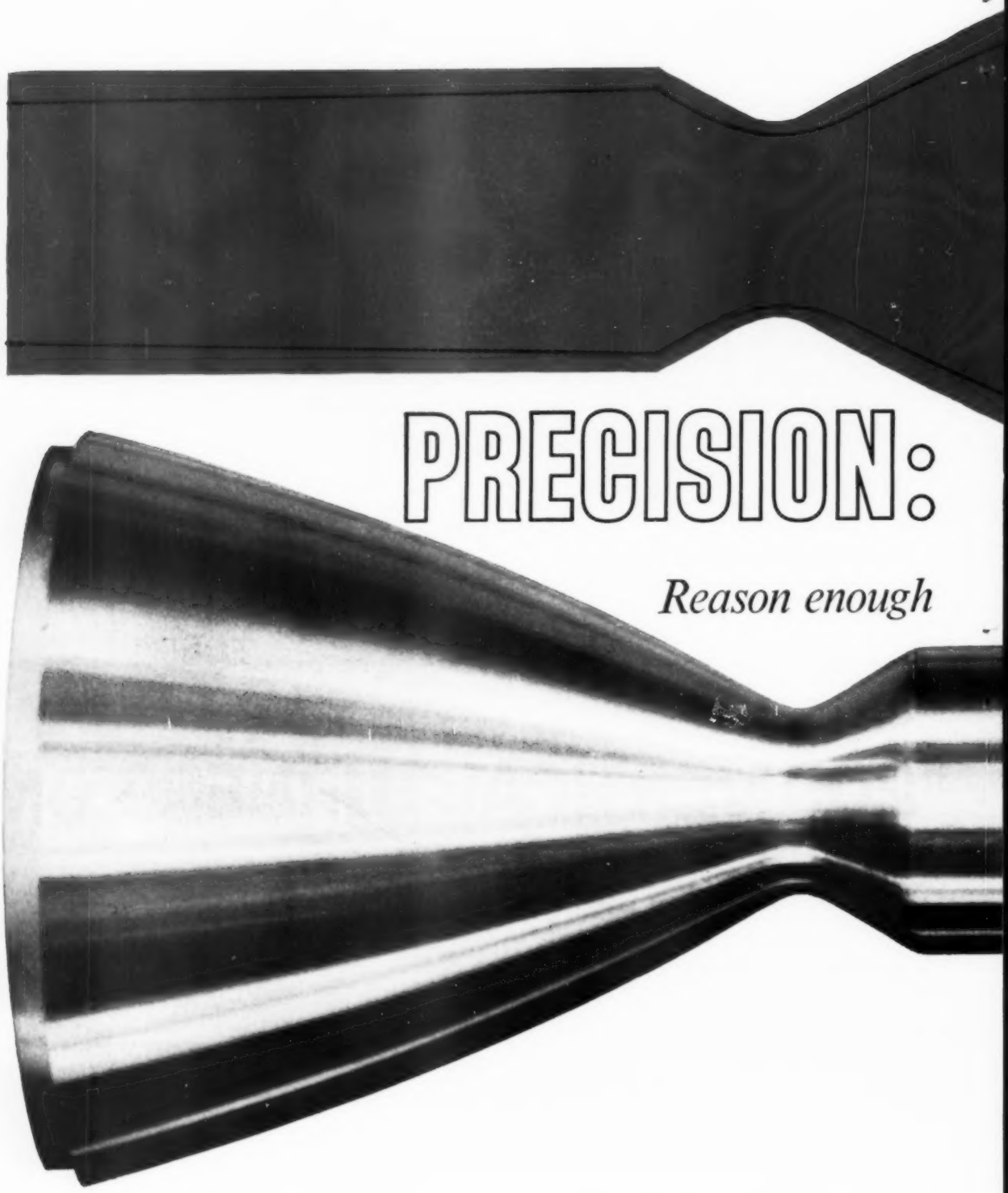
- **separate controls for each spindle and slide unit to permit their independent operation on two-spindle machine (single spindle machines available).**
- **on four-spindle, two column machine, spindles are controlled in pairs, separate controls for each pair.**
- **"building block" design for easily-made tooling and slide changes to accommodate a wide variety of work.**
- **design features accessibility for simple, speedy maintenance of spindles, motors, hydraulic cylinders and/or cams and slides for minimum downtime.**
- **three position automatic turret available for boring, counter-boring, etc.**

We can show you, in detail, how this new adaptable metal-working machine will improve your present machining operations. Call your nearby Motch & Merryweather representative, or write: Motch & Merryweather Machinery Company, 1250 East 222nd Street, Cleveland 17, Ohio.

MOTCH AND MERRYWEATHER

Machine Tool Manufacturing Division
Cutting Tool Manufacturing Division
CLEVELAND
Avey Division, Cincinnati

BUILDERS OF AUTOMATIC PRECISION CUT-OFF, MILLING, DRILLING AND SPECIAL MACHINERY



PRECISION:

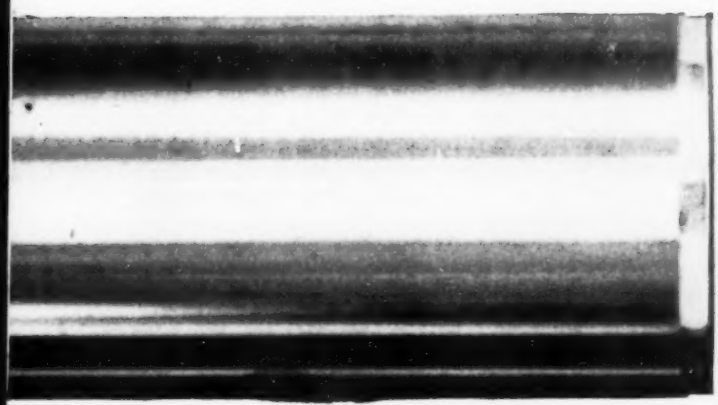
Reason enough

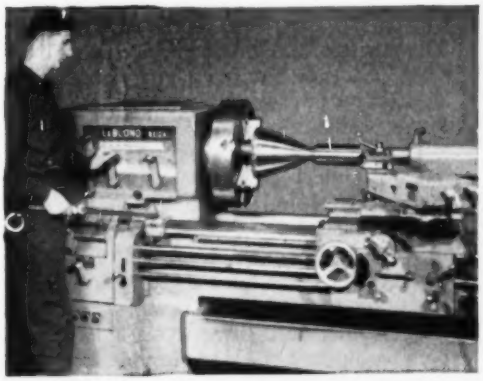
to buy LeBlond

In Hartford, Conn., Delta Corp., specialist in precision fabricating and machining for the aircraft industry, chucks a 350 lb. forging of 347 stainless in its new 24″ LeBlond Regal Lathe. When this missile job comes off the tracer-equipped Regal, it will be a contoured tube weighing only 18 lb. Its walls will vary from ⅛″ to 1/16″ according to a rigid and complex pattern. Wall thickness will be held to ±.003″, ID to −.001″ +.000″, OD to ±.008″, and finish will be 20 to 30 rms. If the job is run 3 or 30 times, the same precise result will be achieved.

Dependable precision, like this, is reason enough to buy a LeBlond. And Delta Corp.'s new 24″ Regal backs it up with the versatility of spindle speeds from 18 to 1080 rpm, the capacity of 26″ swing over the bed, the reassurance of 10 hp at 1800 rpm, the repeatability of Hydra-Trace.

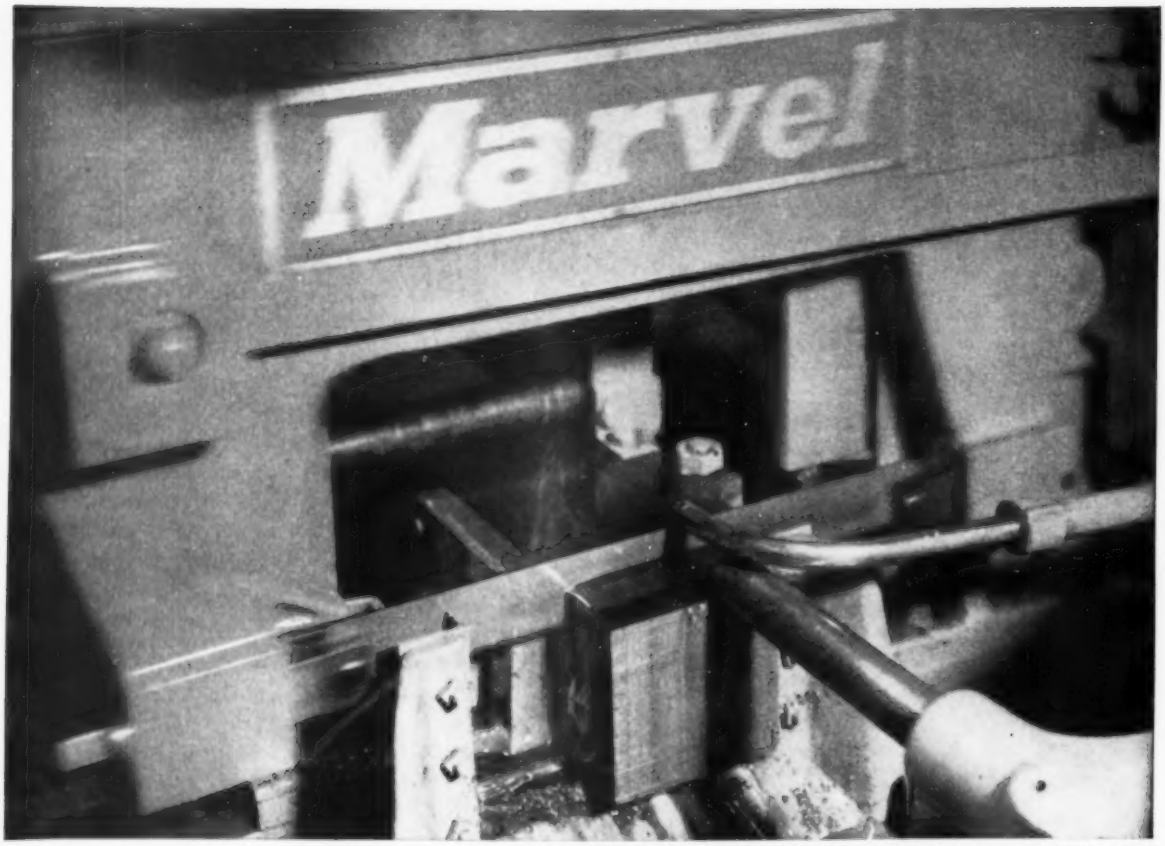
People expect precision with extras from the world's largest builder of a complete line of lathes (and of tracers for lathes, too). They have a right to. It's why they buy LeBlonds.





THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND of Cincinnati



This is a MARVEL High-Speed-Edge Hack Saw Blade Cutting a 4" x 4" Titanium Billet

EVERYTHING'S IMPROVED BUT THE GUARANTEE

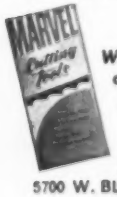
33 years ago, MARVEL introduced the first welded-edge hack saw blades . . . guaranteed them to be shatterproof . . . and a new concept of power hack sawing came into existence.

In combining, by welding, two materials—a narrow, high speed steel cutting edge, and a tough alloy steel body, MARVEL pioneered the modern hack saw blade.

When operators learned they could apply the heaviest feed pressures and highest speeds to the new MARVEL Blades with complete confidence that they would never shatter or "explode" to cause them personal injury, hack sawing began the approach to its present high level of efficiency. Even cutting "exotic" metals, such as titanium, where heavier feed pressures are a necessity, the MARVEL Blade does an outstanding job and is completely safe.

Today's MARVEL High-Speed-Edge Hack Saw Blades are greatly improved, even over the MARVEL Blades which were the best on the market a few years ago. Advanced metallurgy has produced better steels; new heat treating and manufacturing techniques have brought further improvements. The only thing unchanged is the Guarantee: THEY ARE SHATTERPROOF!

If you haven't used MARVEL High-Speed-Edge Hack Saw Blades recently, try them on your saws for a month and see the difference a truly superior blade can mean in higher speeds, greater accuracy, lower cost per cut, and guaranteed safety to operating personnel. Your nearby MARVEL Distributor carries a complete stock of MARVEL High-Speed-Edge Blades.



Write for Bulletin CT-175 which has complete details on MARVEL High-Speed-Edge Hack Saw Blades.

ARMSTRONG-BLUM MFG. CO.
5700 W. BLOOMINGDALE AVE., CHICAGO 39, ILL.

Metal Cutting
MARVEL SAWS
Better Machines—Better Blades

Your best buy in small surface grinders

built to Landis precision grinder standards

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- dependable accuracy
- unit construction for easy inspection and maintenance
- big machine capacity

  12" capacity under a 12" wheel

  a full 150 square inches of surface area

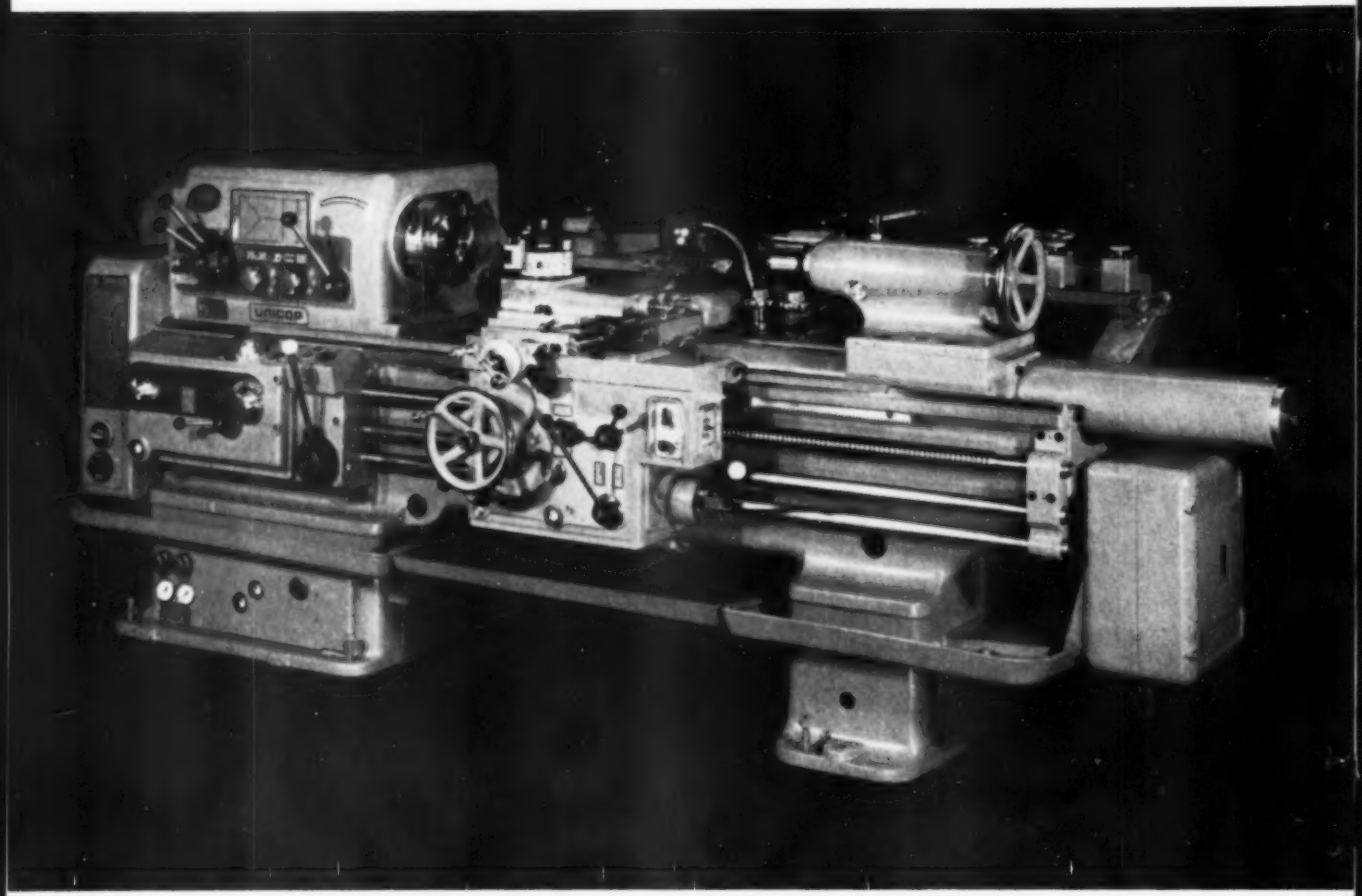
  grind deep with accuracy—3½" under head to bottom of wheel

Send for new catalog of Landis Abrasive Surface Grinders

ABRASIVE
precision surface grinders

a product of
LANDIS TOOL
world's largest manufacturer of precision grinding machinery
WAYNESBORO, PENNSYLVANIA

for quality, craftsmanship and economy,



VDF TRACER LATHES

With these high precision "UNICOP" lathes you can duplicate virtually any turned shape with high accuracy and uniformity, simply by tracing from a template or duplicate workpiece. The "UNICOP" system combines the high sensitivity and instantaneous response of an electronic control unit with the stability and power of hydraulic tool slide operation. The reproductive accuracy of this unit permits copy tolerances of .0004-.0006 inches in a finishing cut. For complete information, ask for Bulletin 128 e.

In addition, VDF also offers a complete line of "HYDROKOP" lathes utilizing a fully hydraulic profile copying system that combines maximum economy, ease of operation and widest size range, being available in machines of any desired length and capacity. For complete details, ask for Bulletin 129 e.

VDF TURRET LATHES WITH AUTOMATIC CYCLE CONTROL

VDF turret lathes with spindle bores of 2" to 4", are equipped with an exclusive "peg-board" automatic cycle control that pre-sets the spindle speeds, direction of rotation and feeds for any given workpiece. Individual spindle speeds and feed rates can be set by two calibrated electric preselector controls. Indexing the turret automatically selects the correct speeds and feeds for optimum production. This automatic control makes this ram-type machine almost as fast as a single-spindle automatic, yet retains the versatility and ease of setup of the turret lathe. Saddle-type lathes with automatic turret indexing are also available.

Like all VDF lathes, these high-production turret machines are designed and built, from base to gear-box, to maintain the highest standards of accuracy and precision. For information, send for Bulletin 107/1e.

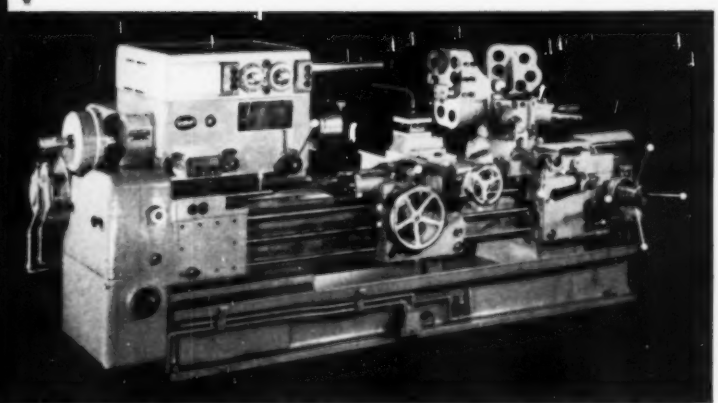
look into the complete line of

VDF LATHES

...now backed by complete engineering and service facilities

VDF lathes, known the world over for quality, precision craftsmanship, versatility and ease of operation, are now available from VDF Lathe Division of Rudel Machinery Company, which offers complete sales engineering and service facilities and maintains a stock of replacement parts for prompt customer service.

The VDF line offers you the widest selection of precision lathes available in the machine tool industry—engine and tool-room lathes, turret lathes, copying lathes, in sizes from 12″ to 80″ swing.

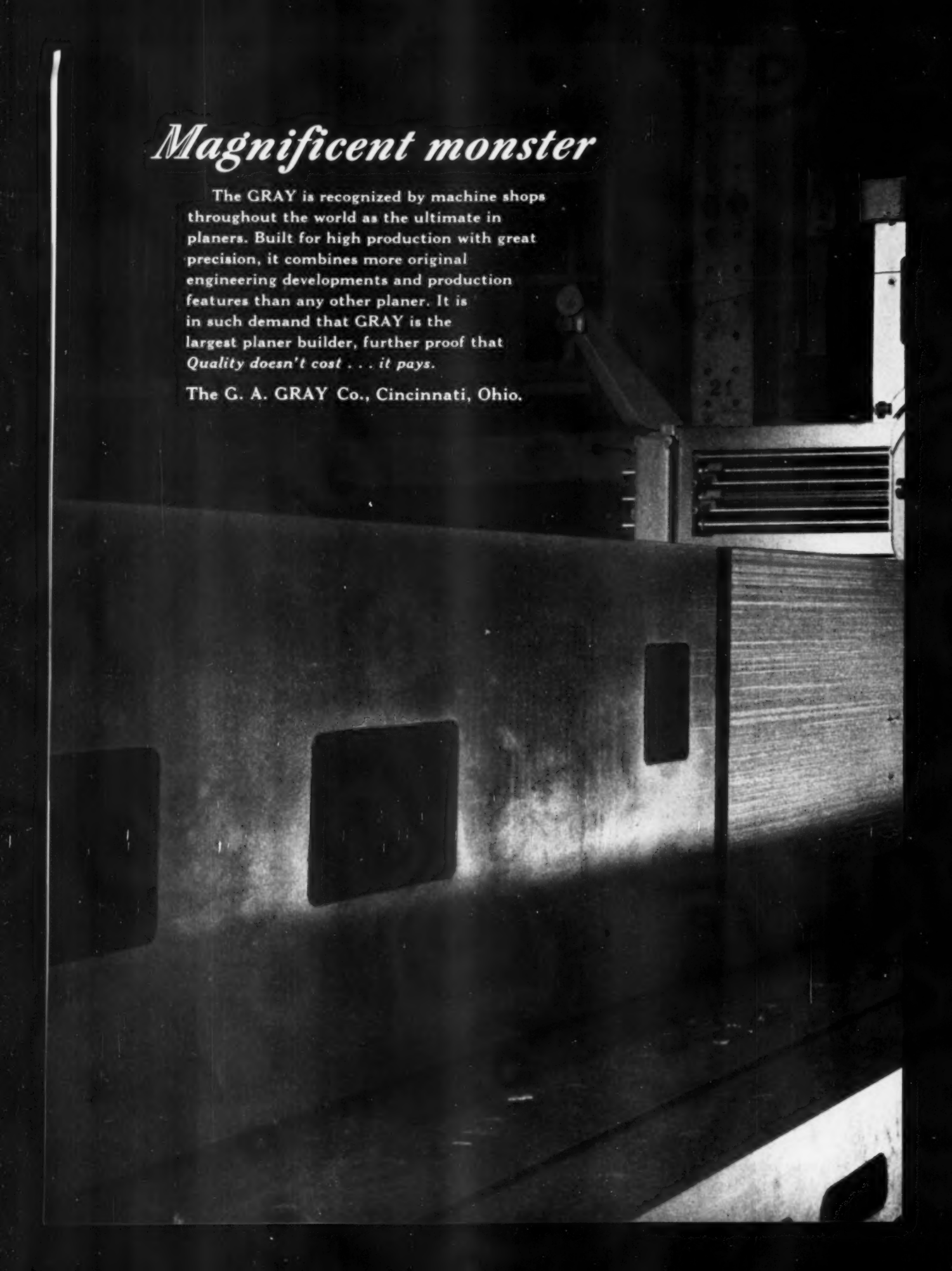


If you want to cut costs without compromising on quality, be sure to get the full story on VDF lathes. Compare them, feature for feature, with other precision lathes. A request to Rudel, specifying the type of lathes in which you are interested, will bring you a completely illustrated bulletin which describes the line of lathes in detail, together with the name and address of your nearest VDF distributor.

VDF Lathe Division of **Rudel Machinery Co., Inc.**
165 MILL LANE, MOUNTAINSIDE, N. J.

CIRCLE 176 READER SERVICE CARD

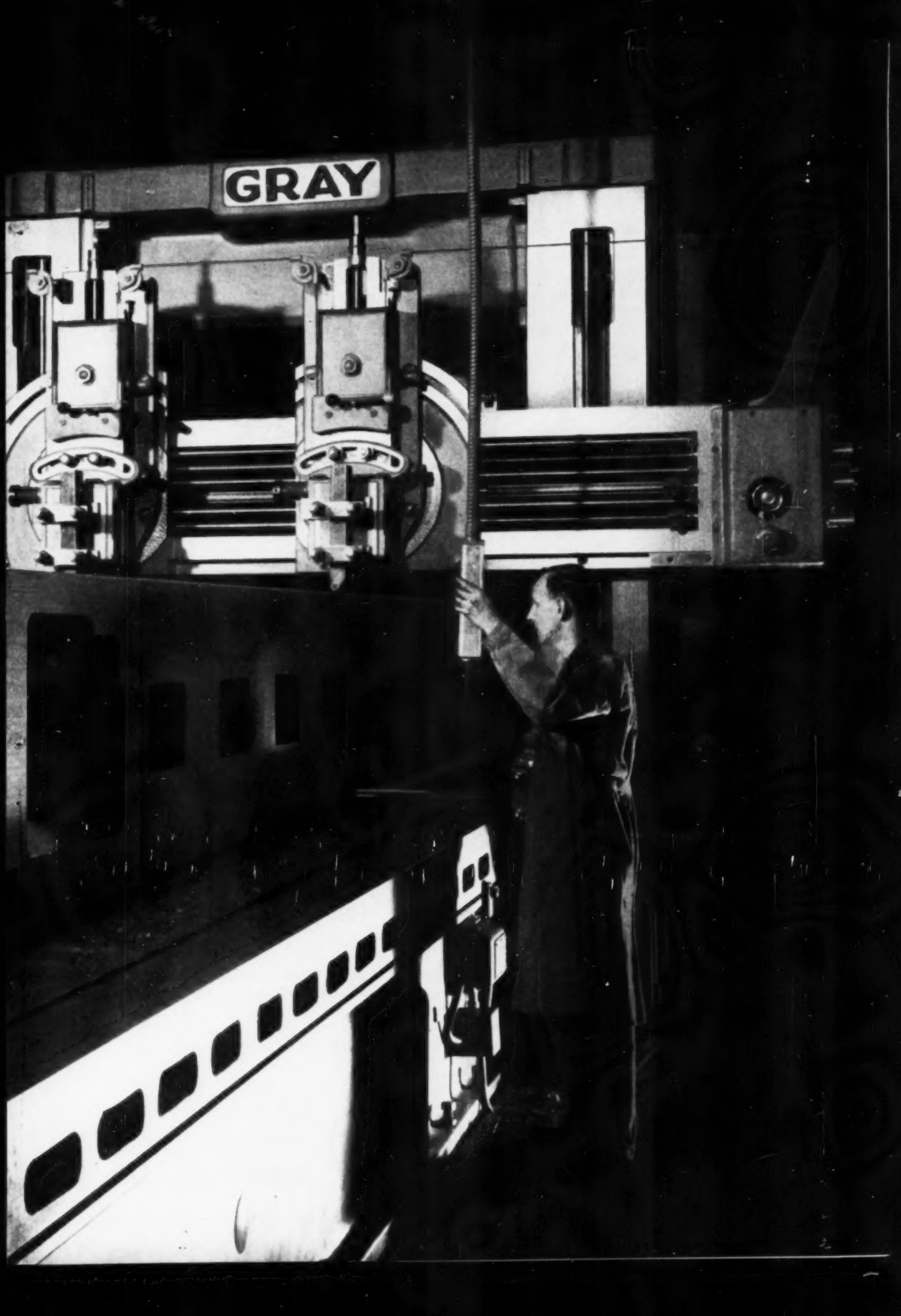
CIRCLE 177 READER SERVICE CARD ►



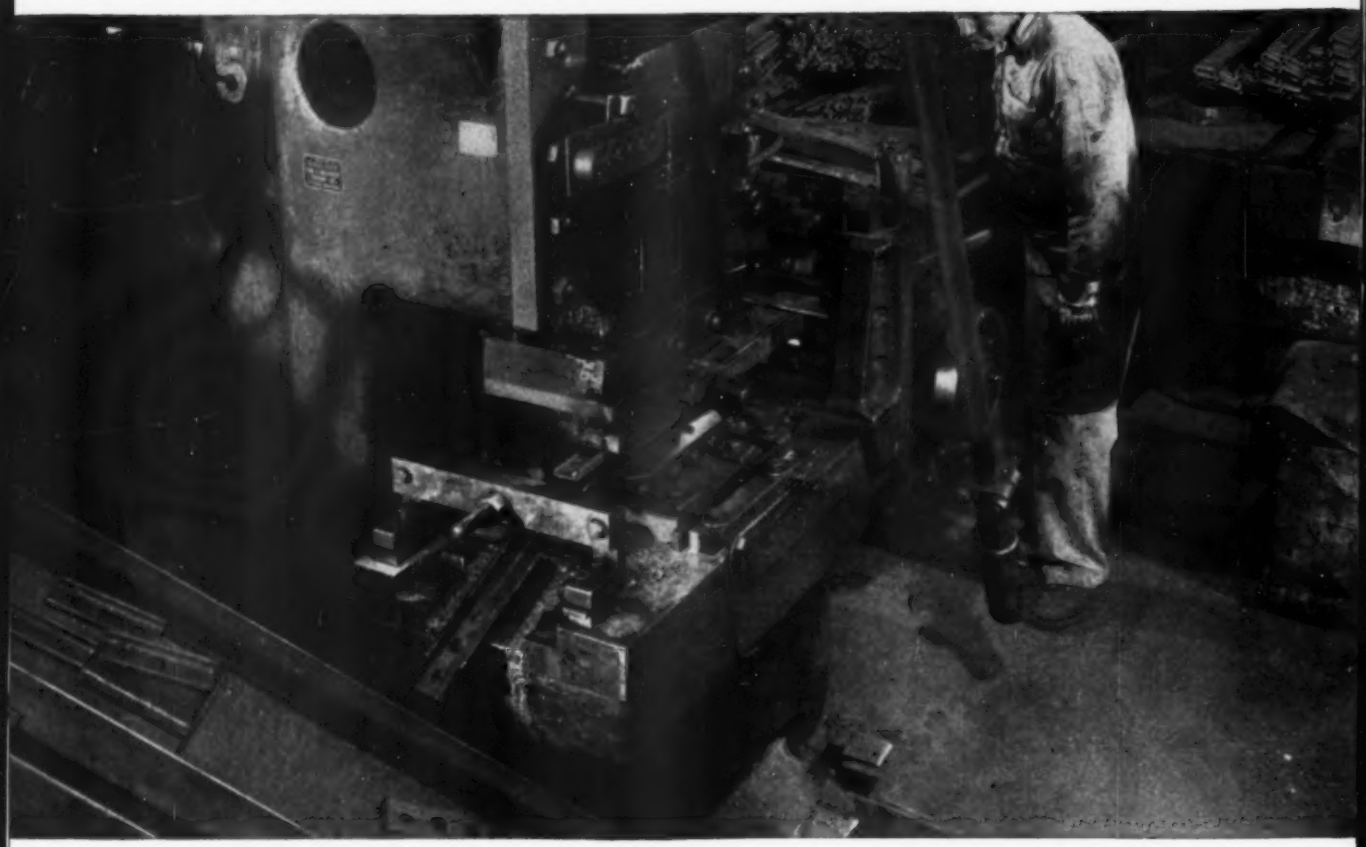
Magnificent monster

The GRAY is recognized by machine shops throughout the world as the ultimate in planers. Built for high production with great precision, it combines more original engineering developments and production features than any other planer. It is in such demand that GRAY is the largest planer builder, further proof that *Quality doesn't cost . . . it pays.*

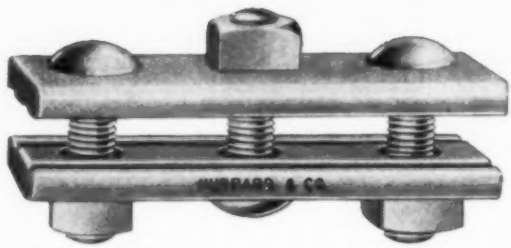
The G. A. GRAY Co., Cincinnati, Ohio.


GRAY

STEEL SHAPED TO CUT COSTS AND IMPROVE PRODUCTS



One automatic operation punches three holes and shears off the part from a USS Hot-Rolled Special Section. No machining necessary.



Hubbard pole line hardware made from USS Special Sections.

Pole line hardware • one punch • made from USS Special Sections

Hubbard and Company is one of the largest pole line hardware manufacturers in this country. They turn out guy clamps, cable suspension clamps and lashing clamps by the thousands. To keep production costs low, they use USS Special Sections already rolled to the proper cross section for the finished piece.

Many items can be punched and sheared in one automatic operation so that there is no machining and very little scrap. Parts can then be galvanized, bolts inserted and the job completed.

How USS Special Sections can reduce your costs. If you have an irregular steel part that must be produced in quantity at low cost, let us check your drawings. Many times a complex and costly assembly can be replaced by the use of one USS Hot-Rolled Special Section. Designs are unlimited. Write for our new book showing many intricate shapes already being produced. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS is a registered trademark

USS

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
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United States Steel

Finish parts fast... economically... by the barrelful!

...with TUMBLEX* "A"

Norton TUMBLEX "A" abrasive gives barrel finishing the "Touch of Gold" advantages, the *fast* way to a *better* finish on your parts. This high production tumbling abrasive of Norton ALUNDUM* aluminum oxide forms radii and finishes to your required microinch reading while removing flash, scale, tool marks, and burrs at high production rates.

Available in a range of fourteen sizes, Norton TUMBLEX "A" abrasive is capable of providing excellent cut and finish on a *wide* variety of work pieces. It will not glaze, but instead will maintain a continuous high rate of cut.

Let our Sample Processing Department show you a better way of finishing. Send us unfinished samples and one finished piece. We will barrel finish samples with TUMBLEX "A" abrasive — or with one of the other Norton TUMBLEX abrasives if more suitable. Our return report will tell you exactly how you can improve product quality while cutting finishing time and costs. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

AVAILABLE SIZES OF NORTON TUMBLEX "A" ABRASIVE

No.	Size	No.	Size
00	1½" to 2"	3½	5/16" to 3/8"
0	1⅛" to 1½"	4	7/32" to 5/16"
1	⅜" to 1¼"	5	3/16" to ¼"
1½	11/16" to ⅜"	6	⅛" to 3/16"
2	5/16" to ¾"	8	3/32" to ⅛"
2½	½" to 5/16"	10	standard 10 mesh
3	3/8" to ½"	12	standard 12 mesh

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

G-378

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

SPREAD RESISTANCE...

WHERE YOU NEED IT!

Five styles in a broad range of sizes and capacities up to 18". Drop-forged from selected steel and heat-treated to further increase strength and reduce liability of springing. Screws are made of special grade steel hardened and tempered.

NEW Alloy Hoist Hooks add 27 additional capacities to Williams extensive line of carbon and alloy steel hooks. Eye and shank styles in regular and safety patterns. Safe working load capacities up to 70 tons. Write for new brochure A-575.

Vulcan Eye Bolts are proof-tested to military standards to 50% beyond "safe working load". Plain and shoulder patterns. Blank or threaded. Capacities from 400 lbs. to 16 tons.

all are stronger and safer because...

THEY'RE DROP-FORGED BY WILLIAMS

FOR PROMPT, PERSONAL SERVICE — CALL YOUR LOCAL DISTRIBUTOR

INDUSTRIAL DISTRIBUTORS — THE HIGH HAND OF PRODUCTION

WILLIAMS
DROP FORGED
TOOLS OF INDUSTRY

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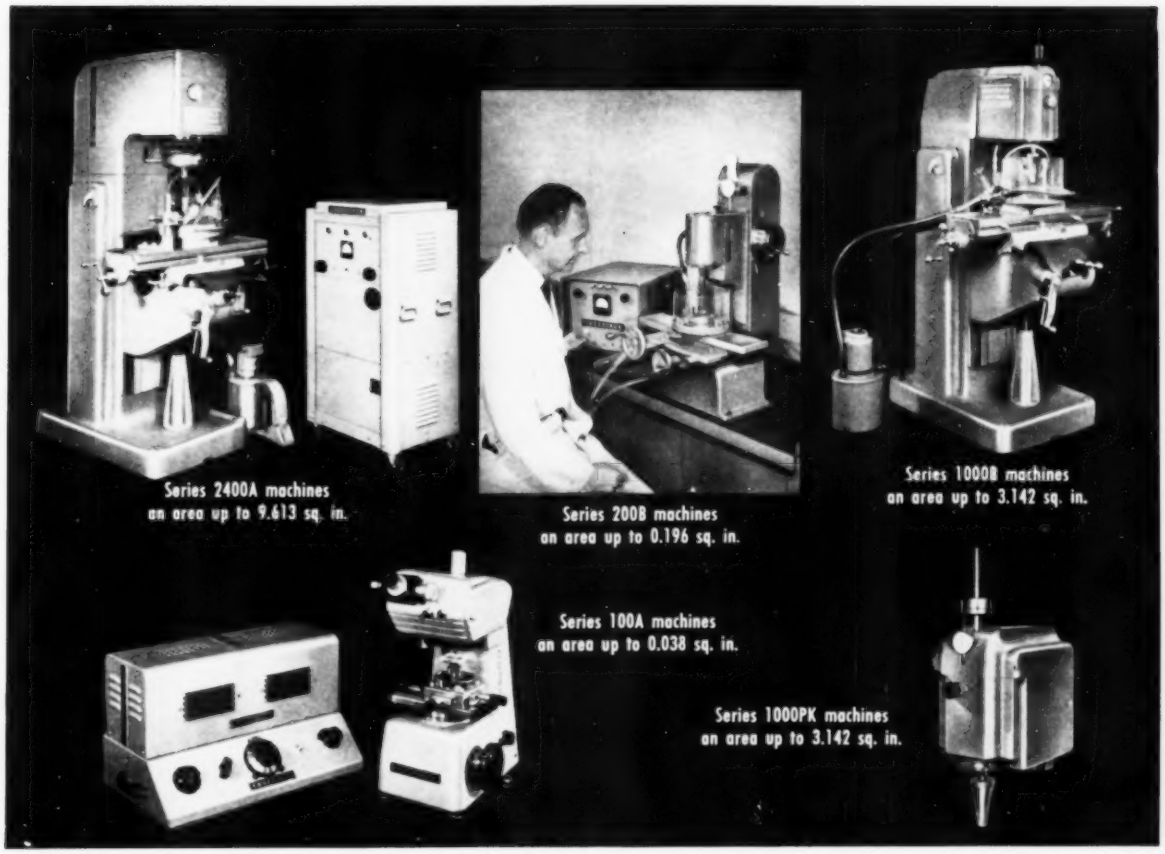
442

MACHINE THE UNMACHINABLE!

THERE'S A SHEFFIELD CAVITRON ULTRASONIC MACHINE TOOL FOR YOUR SPECIFIC JOB


Series 2400A machines
an area up to 9.613 sq. in.
Series 200B machines
an area up to 0.196 sq. in.
Series 1000B machines
an area up to 3.142 sq. in.
Series 100A machines
an area up to 0.038 sq. in.
Series 1000PK machines
an area up to 3.142 sq. in.

Each of these ultrasonic tools economically machines the very hard and very brittle materials such as hardened tool steel, cemented carbide, cermets, silicon, germanium, aluminum oxide and others.

Each of these machines is used to produce dies, transistor components, electronic elements, precision machine parts, servo valves and other products.

Each of these machines drill, contour, slice, dice, coin and engrave.

All have these operating advantages:

- Fast cutting for high production
- Work to close tolerances with excellent surface finishes
- Low tool cost—minimum of machine maintenance
- High precision with semi-skilled operators
- No thermal cracks—no localized annealing
- Provide the designer a freer choice of materials

For detailed specifications, write to the Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. I.

the **SHEFFIELD** *corporation*

of Bendix Aviation

manufacture and measurement for mankind

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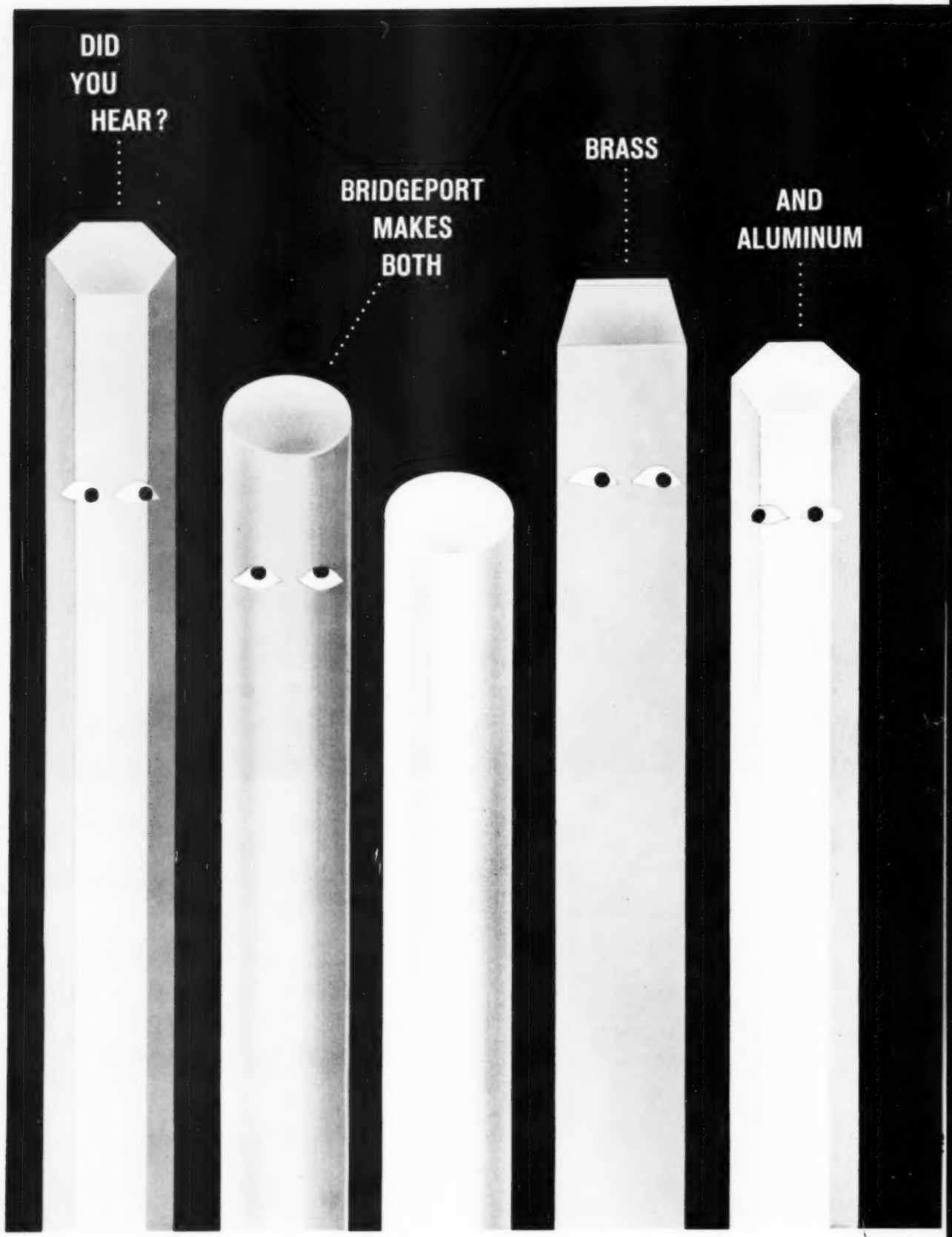
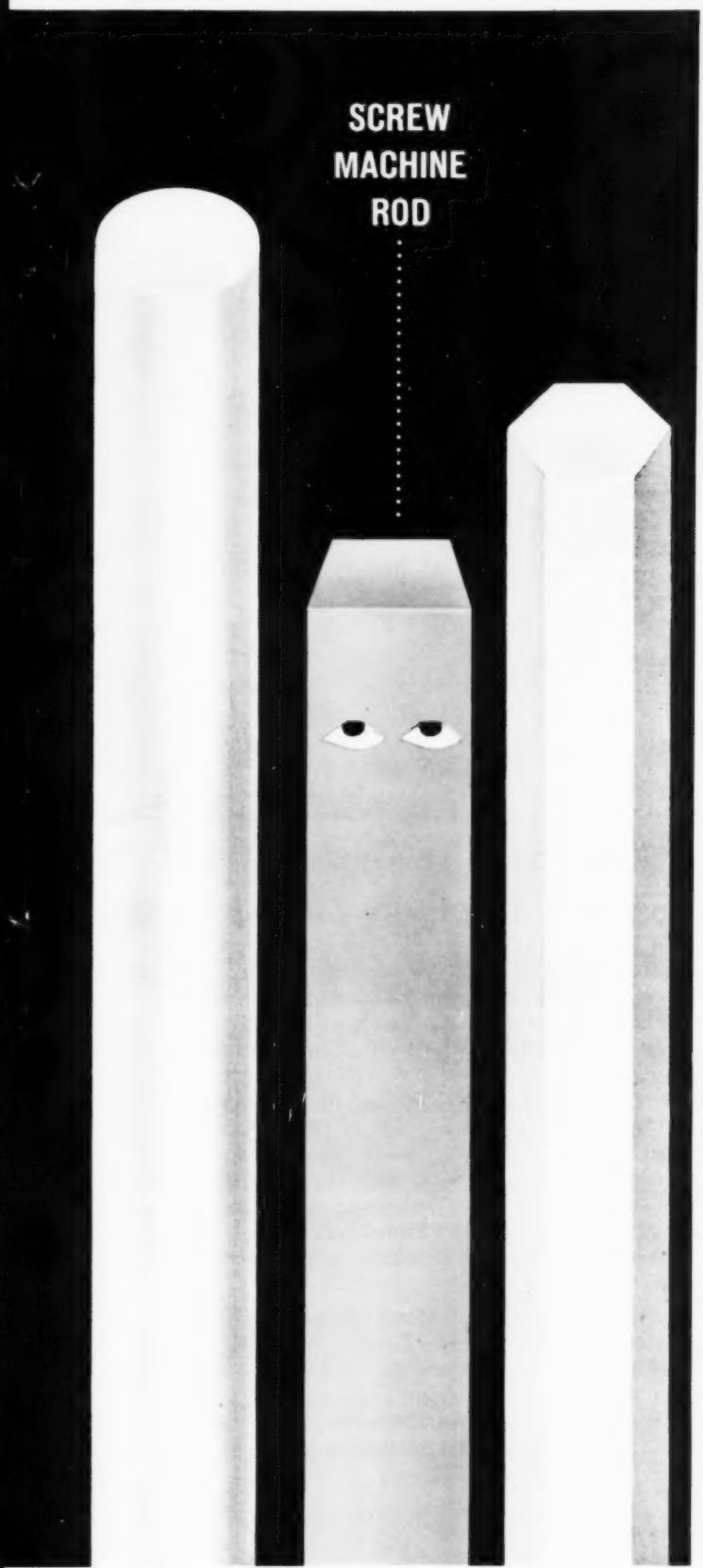

DID
YOU
HEAR?
BRIDGEPORT
MAKES
BOTH
BRASS
AND
ALUMINUM



BUY BRIDGEPORT SCREW MACHINE ROD

Bridgeport has no "metal axe" to grind. We recognize that for some applications aluminum is better... for others, brass is best. Our one objective is *to give you the most suitable material for your specific needs.* That's why you can always rely on the advice of your Bridgeport Salesman—he knows your screw machine needs and can give you the same high quality rod in aluminum or brass. He's backed by our 92 years of metals know-how and our pioneering work in developing high speed rods for the screw machine industry.

He can give fast service, too, because Bridgeport stocks both aluminum and brass screw machine rod in warehouses and mills throughout the country for immediate delivery. For full details, call your nearest Bridgeport Sales Office, or, write directly to Bridgeport Brass Co., Bridgeport 2, Conn. Dept. BA3712

ALUMINUM SCREW MACHINE ROD

TYPES	Round and Hexagon.
SIZES	Diameters in 1/64" increments from 1/2" to 3" in standard 12-foot lengths.
ALLOYS	2011-T3 (Standard temper – heat treated and drawn) 2011-T8 (For applications requiring deep drilling – HT-Drawn-Aged) 2017-T4 (For applications requiring high strength) 6061-T6 (For applications requiring superior corrosion resistance) 2024-T4 (Heat treatable – for applications requiring high strength)

BRASS SCREW MACHINE ROD

TYPES	Round, half-round, oval, square, rectangular, hexagonal and special shapes.
SIZES	Diameters from 1/16" through 4-1/2".
ALLOYS	Free Cutting Brass; Leaded Commercial Bronze; Tellurium Copper; Sulphur Bearing Copper; Hardware Bronze; Leaded Muntz Metal; Leaded Naval Brass; Aluminum Bronze; Free Cutting Phosphor Bronze; Nickel Silver.

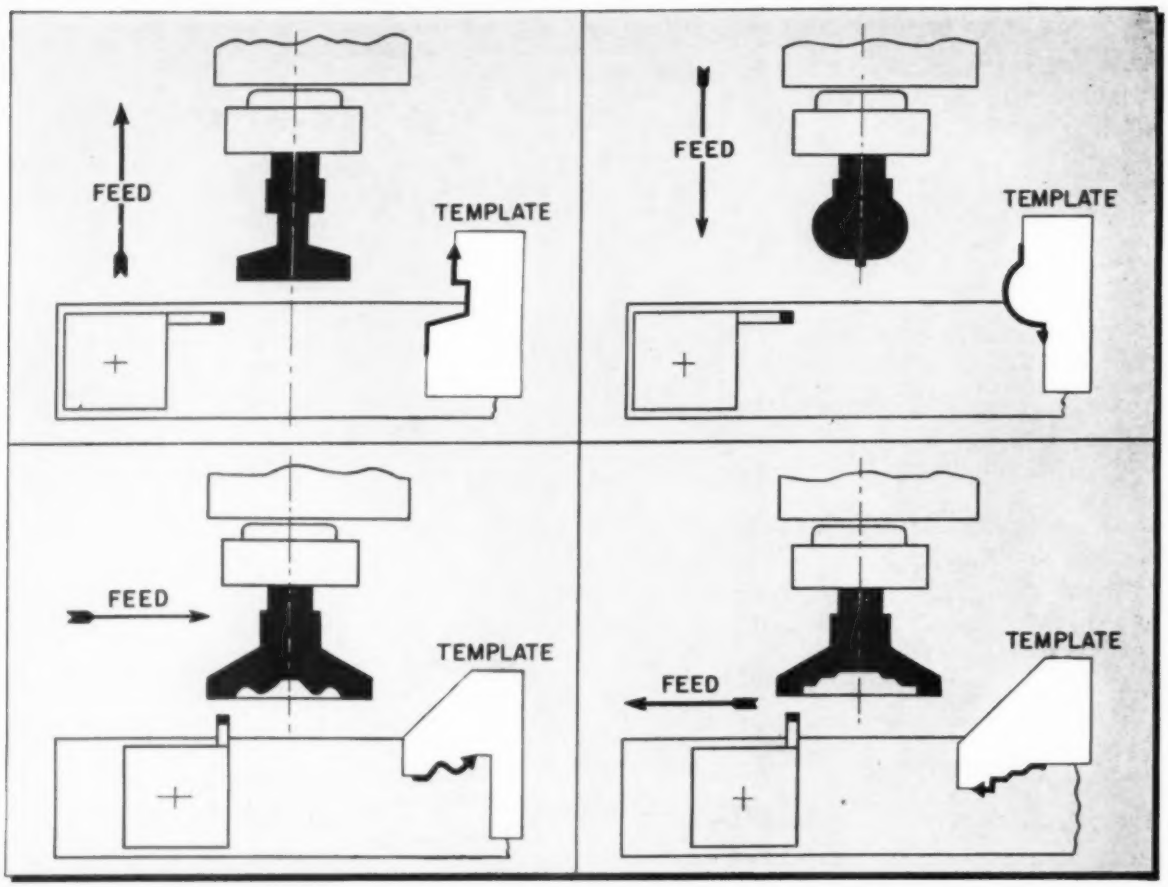
BRIDGEPORT TECHNICAL SERVICE is always ready to help you use metals to your best advantage—in reducing costs, improving alloys or solving your production problems on both brass and aluminum. Ask your Bridgeport Salesman or write to us direct for more details.

BRASS Bridgeport CO.

BRIDGEPORT BRASS COMPANY

Bridgeport 2, Conn. • Sales Offices in Principal Cities

Specialists in Metals from Aluminum to Zirconium



ALL FOUR of these Automatic Tracing Cycles are available with a SINGLE Jones & Lamson Turret Lathe

the man who needs a new machine tool is already paying for it

How's this for machine flexibility in one chucking? (1) You get all of the accuracy and tooling combinations offered by the standard J & L Turret Lathe. (2) You have more than 180° of tool travel control in each of four different automatic tracing cycles (you don't *have* to have *all* four, incidentally). (3) You do both rough and finish tracing (*with rough and finish tools*) in the same set-up. (4) You multiple-tool your tracing operations through 180° of tool control. (5) You have complete control for diameter with the conventional graduated hand wheel on either mechanical or *tracing* operations. (6) The original full swing of the Turret Lathe is retained with this tracer. (7) A single lever disconnects the tracer for standard turret lathe operation.

Such flexibility enables you to perform an amazing amount and variety of work with this new *Two-Dimensional Tracer* on J & L Saddle Type Turret Lathes.

It all adds up to: MAXIMUM WORK COMPLETED IN ONE CHUCKING; REDUCED HANDLING TIME; INCREASED ACCURACY. Write for further information.

JONES & LAMSON Machine Company • Dept. 710, 502 Clinton St., Springfield, Vt.

Turret Lathes · Automatic Lathes · Tape Controlled Machines · Thread & Form Grinders · Optical Comparators · Thread Tools

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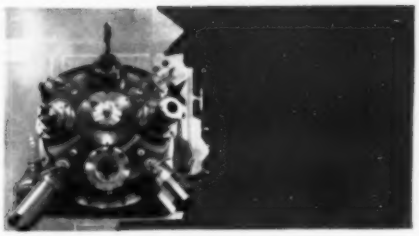
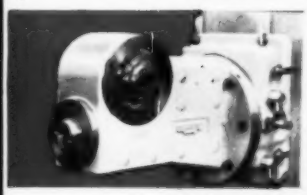
INNOCENTI
mechanical division

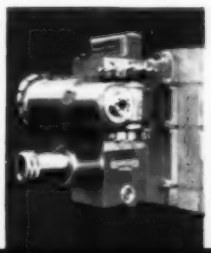
milling and boring machine

The INNOCENTI CWB milling and boring machine allows the solution of the most difficult working problems in the most rational way. This is achieved thanks to the exceptional performances of the machine and to the variety and flexibility of the equipment used with the machine.

The face plate of the headstock is patented and is especially designed for the application of a large range of interchangeable heads for any working requirement.







INNOCENTI technicians besides the standard types are in a position to study for you the unit that can accomplish the outmost economy in the most difficult stages of your machining operations.

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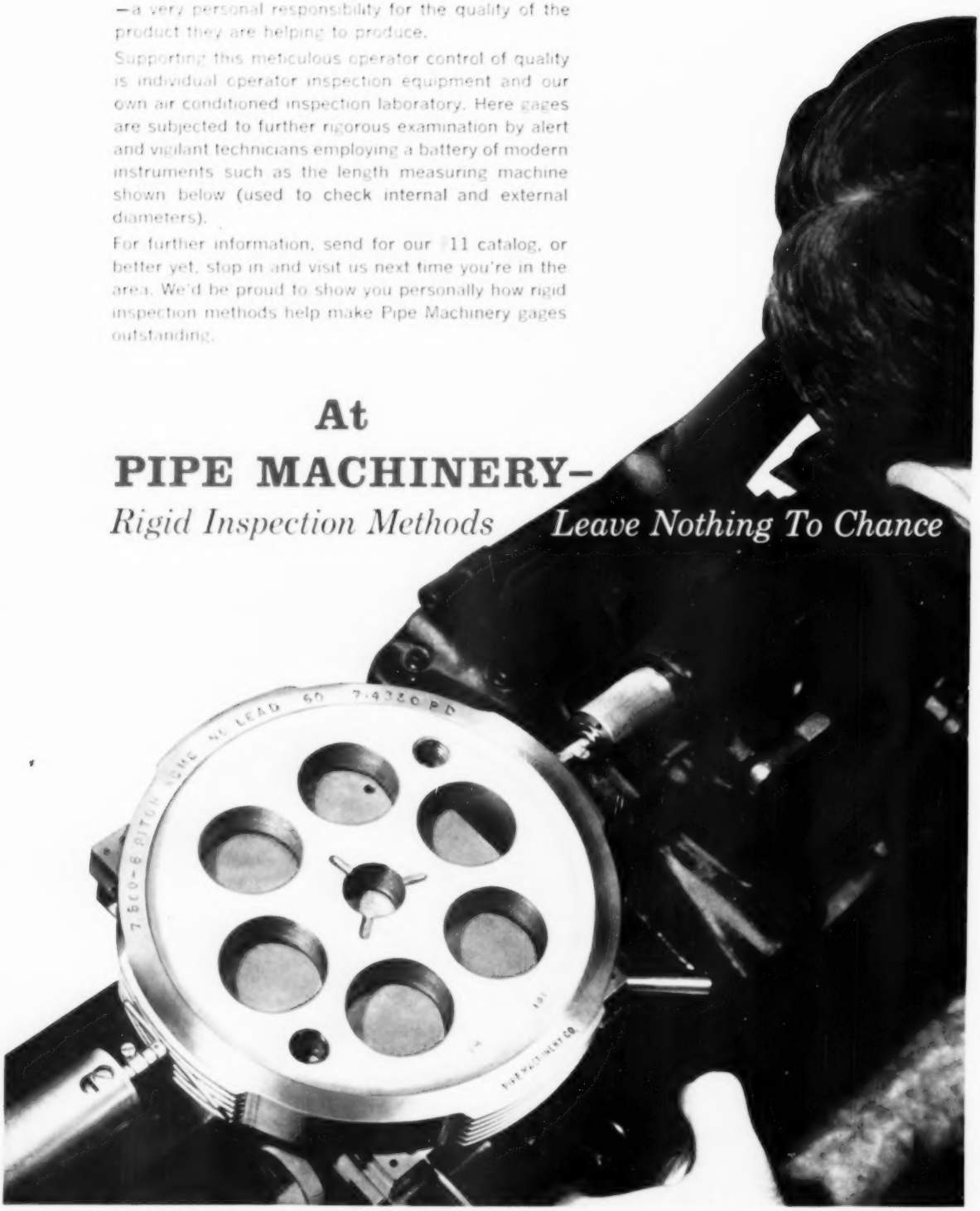
Through each and every stage in the manufacture of a Pipe Machinery gage, our operators feel a very real —a very personal responsibility for the quality of the product they are helping to produce.

Supporting this meticulous operator control of quality is individual operator inspection equipment and our own air conditioned inspection laboratory. Here gages are subjected to further rigorous examination by alert and vigilant technicians employing a battery of modern instruments such as the length measuring machine shown below (used to check internal and external diameters).

For further information, send for our #11 catalog, or better yet, stop in and visit us next time you're in the area. We'd be proud to show you personally how rigid inspection methods help make Pipe Machinery gages outstanding.

At PIPE MACHINERY–

Rigid Inspection Methods Leave Nothing To Chance



THE PIPE MACHINERY COMPANY • 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

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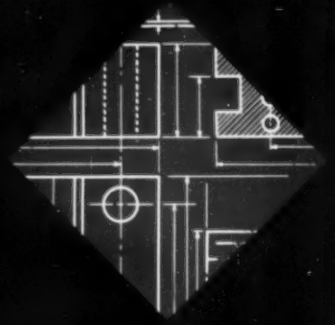

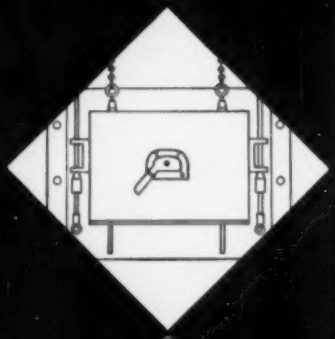

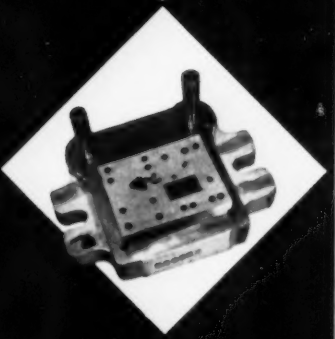

ega

(A.I.S.I. Type A-6) free-machining, air-hardening tool and die steel moves every job from start to finish with exceptional speed, simplicity and safety. It is tougher, hardens deeper and is less sensitive to overheating than other air-hardening grades including A-4 types. No other air-hardening steel resists size change and distortion so dependably, or is so easy to machine. And only Carpenter Vega-FM, produced by MEL-TROL®, assures such overwhelming uniformity. Call your Carpenter SERVICE-CENTER for prompt delivery.

the *Carpenter* Steel Company, Reading, Pa.

For the deepest draws on the toughest metals

Johnson's 700 WAX-DRAW does every draw in the shop. *Easy to apply* by roller coating, spraying, dipping, etc. Use wet or dry. Blanks can be fed directly into the press or may be pre-coated, dried and palletized. *Easy to remove*, using solvent bath, vapor degreaser, alkaline washer or even hot water alone. *Money saving.* One gallon undiluted covers 2,000 square feet. Four-to-one dilutions produce excellent results. 700 Wax Draw handles multiple draws with only one application even at pressures to 200,000 p.s.i. and temperatures to 450°F.

For further information write: **JOHNSON'S WAX** Racine, Wisconsin, Dept. AM1130

Another great metalworking product from Johnson's Wax Service Products Division

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TYPE 101

METALITE®

ANOTHER DEVELOPMENT OF **BEHR-MANNING CO.**
TROY NEW YORK
A DIVISION OF NORTON COMPANY NORTON ABRASIVES

METALITE 101 Discs and Belts come with "built-in zip" to speed production

Here is the perfect disc for roughing or cutting down projections such as weld beads. TYPE 101 METALITE FIBRE Discs run cool — giving fantastic mileage.

Want to lick high finishing costs? . . . try the new TYPE 101 RESINALL METALITE Cloth Belts for uniform grinding and faster finishing. Ask your BEHR-MANNING representative for a free demonstration . . . or write for information to Dept. IA-10.

BEHR-MANNING CO.

TROY, NEW YORK

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NORTON ABRASIVES®

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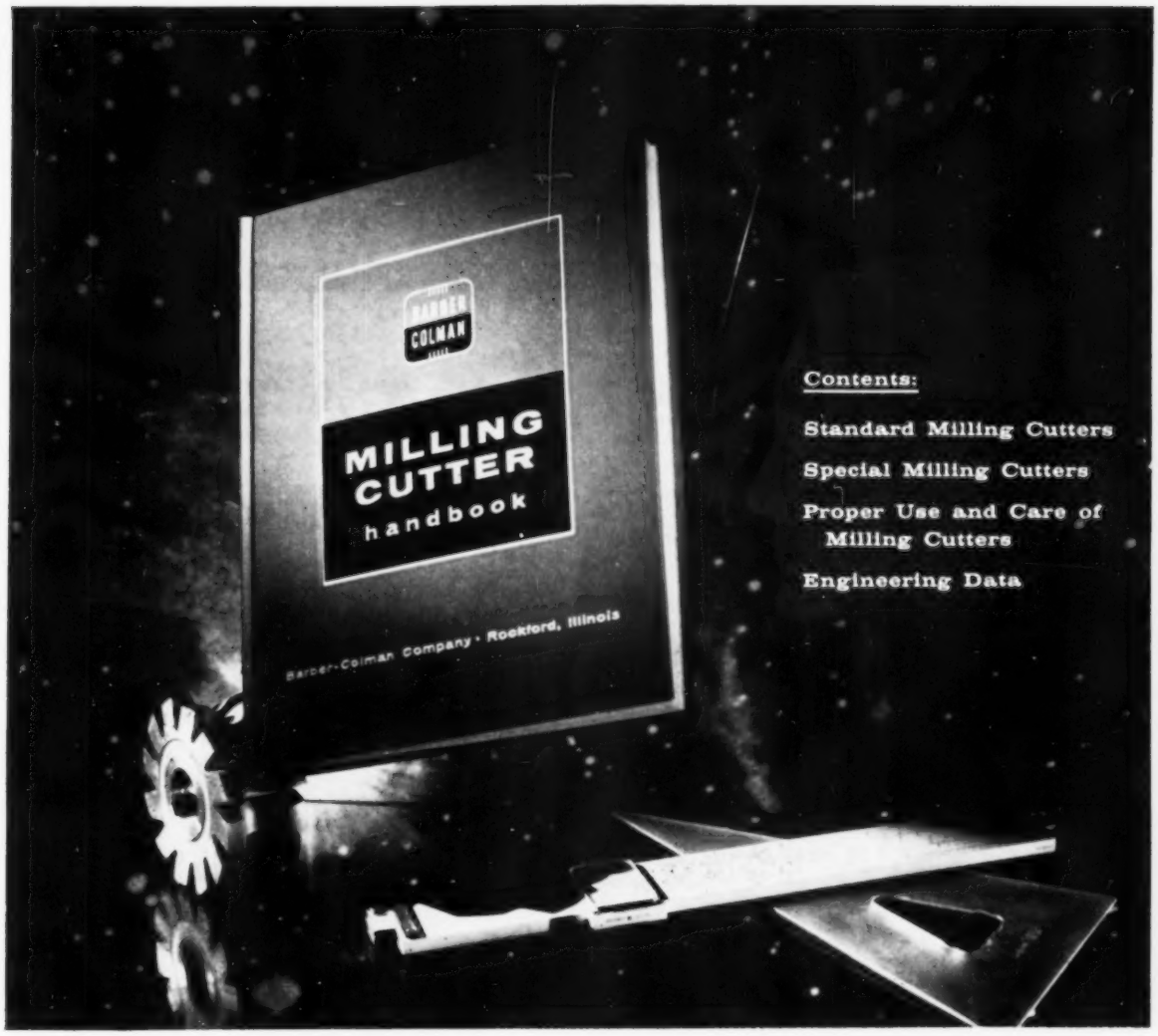

NEW! 220-Page Milling Cutter Handbook

For tool buyers: Here, in a single, easy-to-use volume are all the facts you need for selecting and using standard and special milling cutters . . . high-speed steel and carbide-tipped cutters to meet almost any milling requirement you can name.

The section on special milling cutters will help you minimize problems involved in specifying and ordering. Hints on care and sharpening assure highest performance on the job and help you reduce cutter replacement costs.

Authoritative engineering data completes this comprehensive, one-reference technical handbook . . . available now from your Barber-Colman representative or tool distributor. Call him, or address your inquiry to the factory.

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111 Loomis Street, Rockford, Illinois

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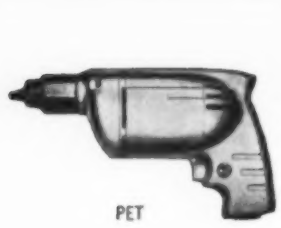

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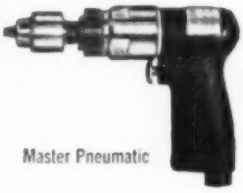
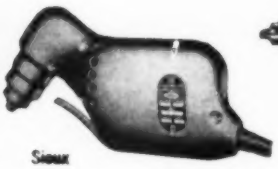
Milwaukee

Pioneer

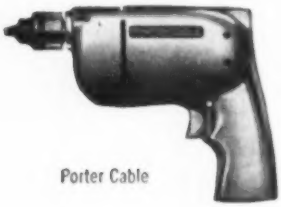


Master Pneumatic



Sioux

Millers Falls



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Your industrial supply distributor makes it his business to know your business. He is always available and ready to fill your needs quickly, dependably and economically. When you need chucks, you can depend upon Jacobs and the Jacobs industrial supply distributor who works with you . . . your partner in progress through service.

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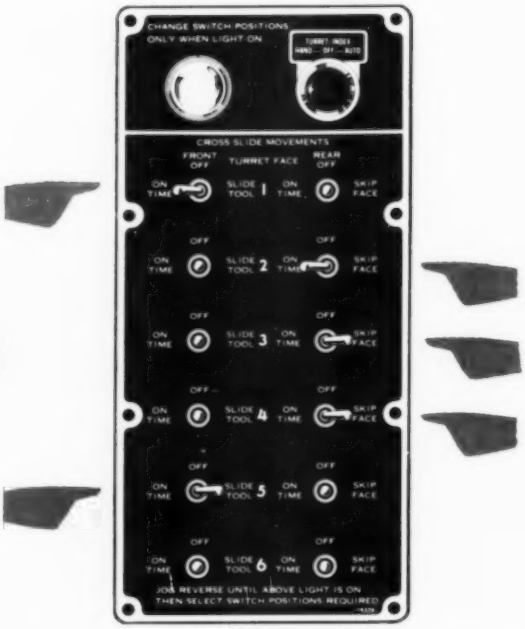
AN ALL-NEW MACHINE . . . WITH ALL THE

NEW SELECTOR SWITCH CROSS SLIDE CONTROL

This new control system lets you set all cross slide movements by merely operating selector switches. There are no covers to remove or replace, no pins or rolls to relocate. Setup is much faster and easier . . . programming is much more flexible. Front and back slides can be set for on-time or delayed motion relative to the turret movement—without *any* restriction to the sequence pattern. Both slides can be operated together or independently with any turret face and can be adjusted longitudinally, independent of each other.

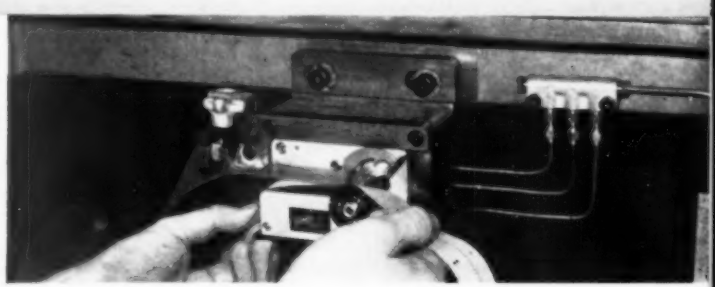
TURRET FACE No. 1—Front Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 3—Rear Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 4—Front Cross Slide is *delayed* relative to the turret motion, for slide tool operation.
TURRET FACE No. 5—Front Cross Slide is *delayed* relative to the turret motion, for slide tool operation.



TURRET FACE No. 1—Front Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 2—Rear Cross Slide operates *on time* relative to the turret motion.
TURRET FACE No. 3—Skip turret face.
TURRET FACE No. 4—Skip turret face
TURRET FACE No. 5—Front Cross Slide is *delayed* relative to the turret motion, for slide tool operation.

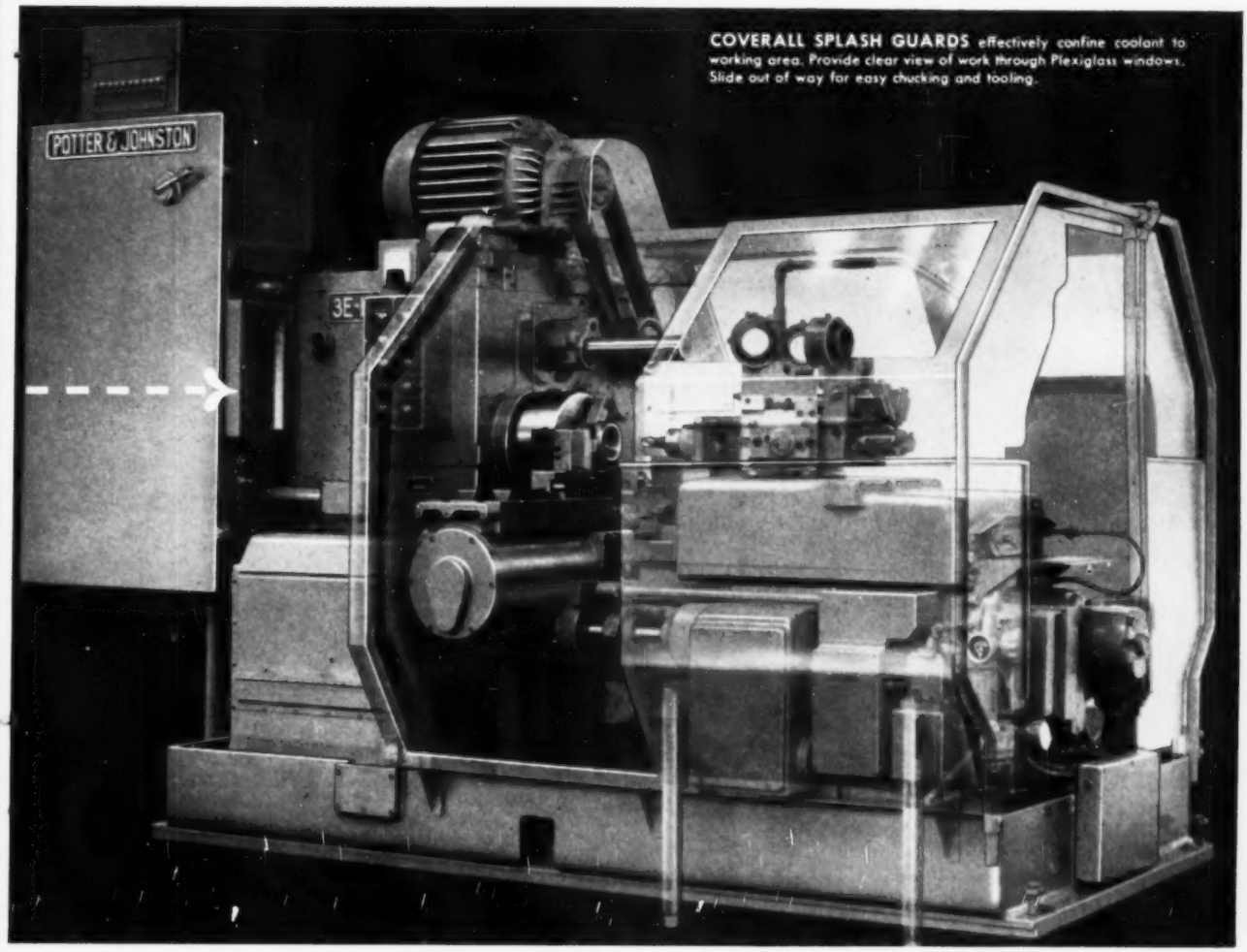
OPTIONAL TAPE CONTROL

Simple in design, easy to understand and operate, and priced far below other systems, P&J Tape Control can save up to 25% in machining and setup time. Tape controls all movements of the spindle, turret and cross slides, including all speed and feed changes. Tape preparation for the average job takes less than 30 minutes and requires no technical knowledge. Programming setup time is eliminated by placing the tape in the machine's tape reader—which only takes a couple of minutes. Optimum programming is assured, with parts machined in minimum time.



3E-15 Automatic

ADVANCED-DESIGN FEATURES YOU'RE LOOKING FOR!



COVERALL SPLASH GUARDS effectively confine coolant to working area. Provide clear view of work through Plexiglass windows. Slide out of way for easy chucking and tooling.

The Potter & Johnston 3E-15 Automatic Turret Lathe is a truly new machine from the base up—*not* just an old model with a "face-lifting!" In addition to Selector Switch Cross Slide Control and Optional Tape Control, this machine also offers many other important new design and construction features, including: A new 15 hp headstock, with power to spare for fast metal removal with carbide tooling; greater rigidity throughout for faster roughing and more accurate finishing; "Control Zone" operation for faster, easier, more convenient setup and machining; separate drive for turret indexing for faster, easier setup; self-adjusting electric clutches that never require maintenance; a central, automatic lube system with single point fill; and a 6-face turret that allows more cuts per automatic machining cycle.

ON-THE-JOB PERFORMANCE . . . has already proved the ability of the P&J 3E-15 to cut machining time and costs. For a complete description of all the 3E-15 features, send now for your free copy of Circular No. 177 Pratt & Whitney Company, Inc., 11 Charter Oak Boulevard, West Hartford, Connecticut.

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FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

NEW FROM FAIR STREET • HOME OF THE JIGMIL

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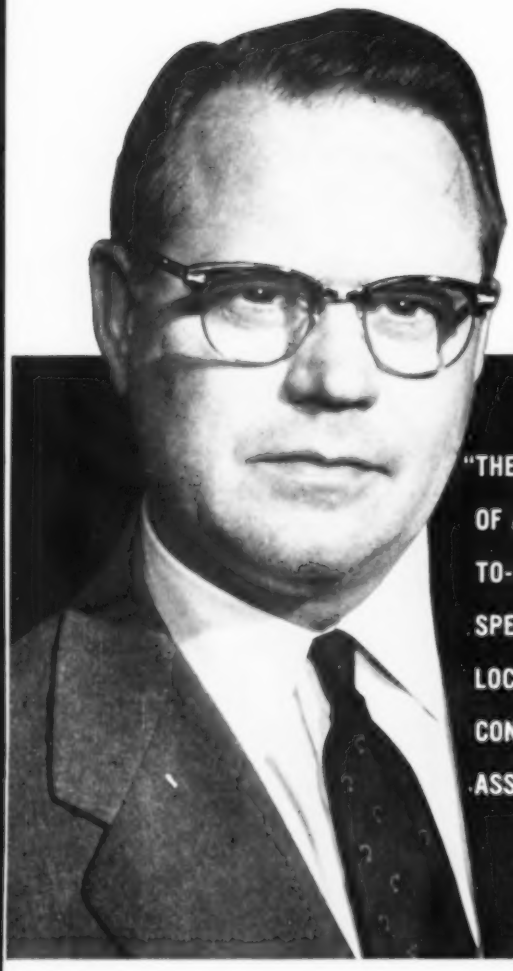
direct dial dimensioning system



"THE DIATROL SYSTEM OF AUTOMATIC POINT-TO-POINT POSITIONING SPEEDS UP SPINDLE LOCATION, SIMPLIFIES CONTROL AND ASSURES ACCURACY"

"Simply dial in the pre-selected coordinate dimensions, touch a button, the rest is automatic. The JIGMIL table and spindle head automatically position at the desired hole location in seconds. While the JIGMIL is machining, you can *pre-set* your next move. Developed by our own engineers, Diatrol adds to the inherent versatility and accuracy of the JIGMIL, further reducing human error as well as set-up and machine time. *Diatrol makes it possible to machine custom or small lot jobs at production rates.*"

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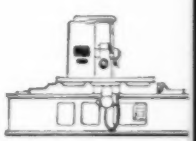

DEVLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

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CIRCLE 198 READER SERVICE CARD ►

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Simple! Accurate! Automatic! Diatrol is a transistorized electro-mechanical system, simple in design and simple to operate. All settings are made on direct reading dials; one dial for horizontal, the other for vertical dimensioning. Direct dialing of positive or negative dimensions is possible from any arbitrarily selected datum plane or zero point within the range of the system. Coordinate dimensions can be fed direct from the blue print, eliminating much of the mathematics formerly required for accurate jig boring. Measurement and positioning accuracies are controlled to one-ten-thousandth of an inch. Developed exclusively for the JIGMIL, Diatrol is now available for the complete range of JIGMIL precision boring and milling machines. For complete information, write or arrange a visit to Fair Street.

Rewarding revelations in precision await your visit to Fair Street

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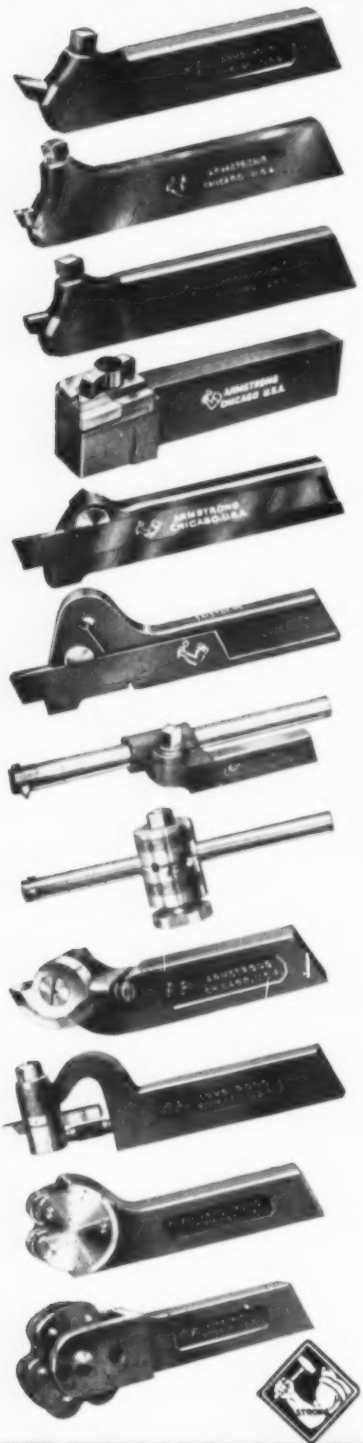
SPIRAMATIC JIGMILS

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

ARMSTRONG

TOOL HOLDERS



A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

Check over your ARMSTRONG Tool Holder needs. Write for literature.

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. CHICAGO 46, ILL.

"Our first Natco ran twelve years without an overhaul!"

— says Harry L. Morley, plant manager of Alloy Steel Products Co.

(see other side)

From this job drilling four 1¼" holes in a stainless steel casting . . .

The operator changes the set-up to eight ⅞" drills in new locations . . .

And starts up again on the new job with only 15 minutes downtime.

"We can change set-ups in 15 minutes or less."

Now, five multiple-spindle Natcos keep production moving at Alloy Steel Products Company, Linden, N. J. Aloyco makes industrial stainless steel valves for the chemical, petrochemical, synthetic fiber, missile and atomic power industries.

Ideal for stainless—Aloyco's materials are hard-to-machine stainless and corrosion-resistant alloys. The steady hydraulic pressure of Natco machines keeps the tools moving into the work and gentles them through the critical break-through point. There's no ease-up to let work hardening start. Drill life stretches out.

Ideal for short runs— Aloyco's production runs aren't long, ranging from 10 to 400 pieces (100 pieces is average). With such short runs, fixtures have to be simple to pay off.

Ideal for cutting costs— An inexpensive guide plate is C-clamped on the face to be drilled and they see no need to fasten the part to the table. Natco C3Bs' accurate alignment, rigidity, lack of vibration and steady feed pressure frequently make permanent fixtures unnecessary.

With a single Natco multiple-spindle machine in your plant you add the productivity of a whole battery of specialized drilling, tapping, and boring machines. Call your Natco representative today.

NATCO

Multiple-spindle drilling, boring, facing and tapping machines.
Special machines for automatic production. Injection molding machines.

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, INDIANA

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FOR BETTER PERFORMANCE — BETTER PRODUCTION

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STYLE "S"
MASTER COLLETS and PADS
The Only Master Collet with
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MASTER FEED FINGERS and PADS
Pads Cannot Work Loose
No Screws — No Pins
Available For: Brown & Sharpe
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New Britain—Warner & Swasey

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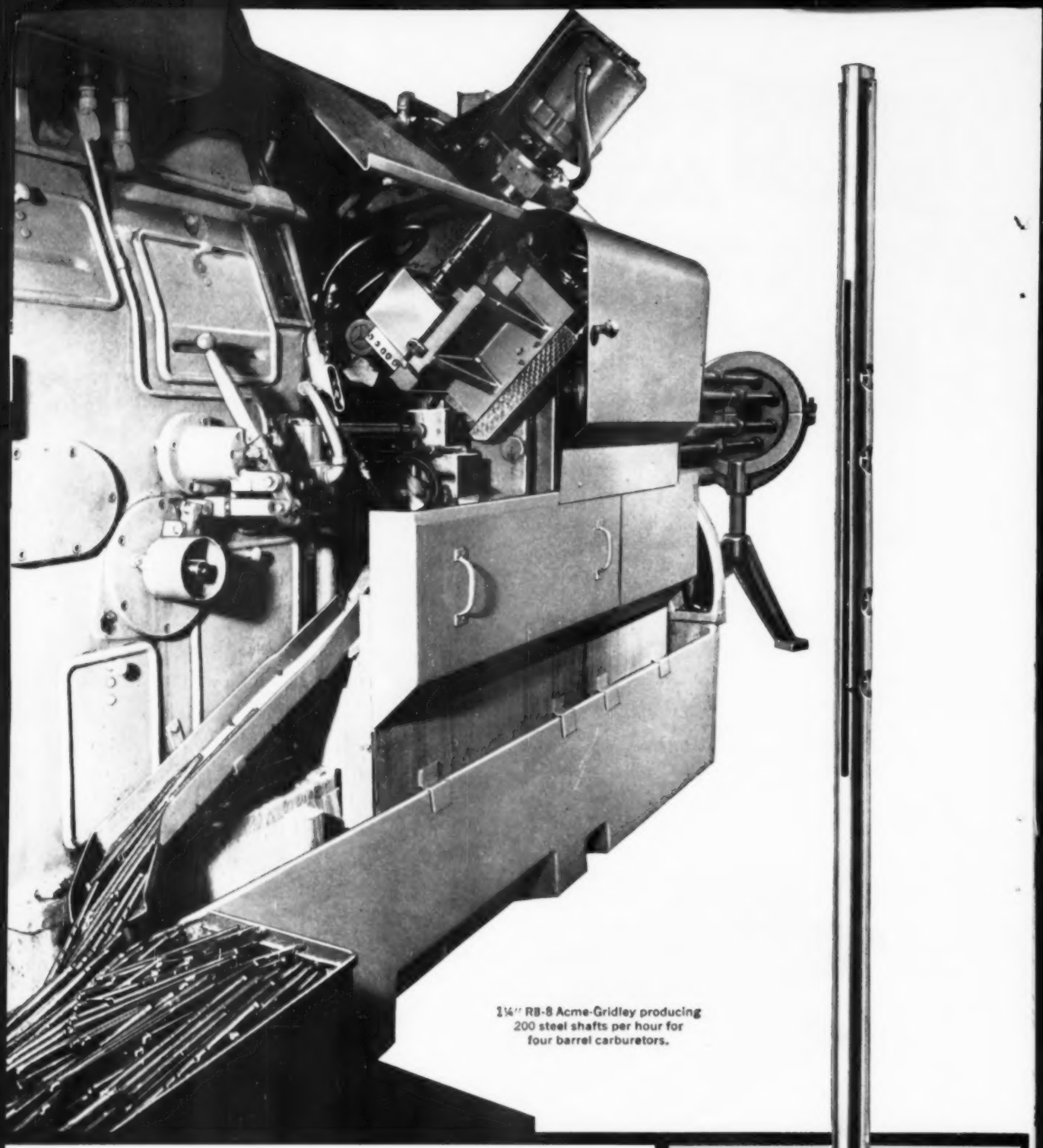
◄ CIRCLE 201 READER SERVICE CARD

CIRCLE 202 READER SERVICE CARD



1¼" RB-8 Acme-Gridley producing 200 steel shafts per hour for four barrel carburetors.

NATIONAL ACME'S

INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS . . . Then Check National Acme

Direct Costs: these include direct dollar savings as realized by Carter Carburetor . . . an "every day" job for Acme-Gridleys.

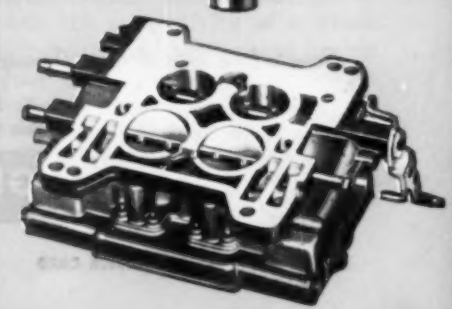
Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.



Versatile Acme-Gridley produces

EIGHT DIFFERENT PARTS

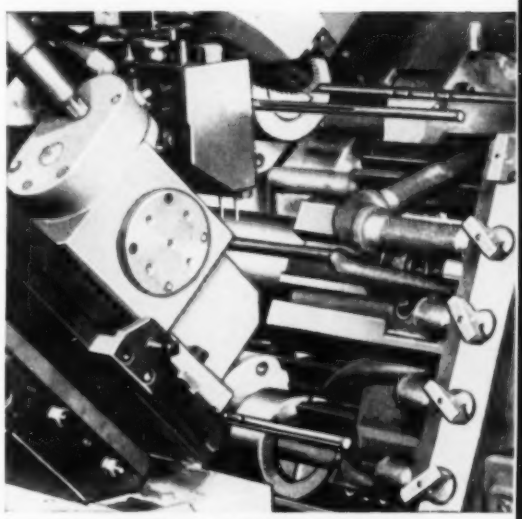
With Only Minor Changes in Tooling Setup

For Carter Carburetor division of ACF Industries, Inc.

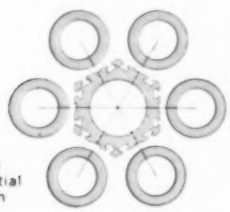
Here's machine tool versatility at its best . . . versatility that provides documented cost savings for Carter Carburetor year in and year out. Machine investment and cost-per-piece are greatly reduced. Illustrated is but one example.

The spindles of a standard $1\frac{1}{4}$" RB-8 spindle Acme-Gridley bar automatic were locked against rotation with a simple spindle locking device. Each spindle functioned as a work holder when the machine indexed from position to position. The inherent accuracy of Acme-Gridleys assured precise alignment of the work with the standard and special attachments . . . whether it's the first or last piece in the run. When spindle rotation is desired, the locking device is simply removed and replaced by the spindle drive gear.

Check the industry's most modern approach to tangible cost reduction. Call, write or wire today!



Close up of tooling zone showing milling of slot in 4th position.



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National Acme

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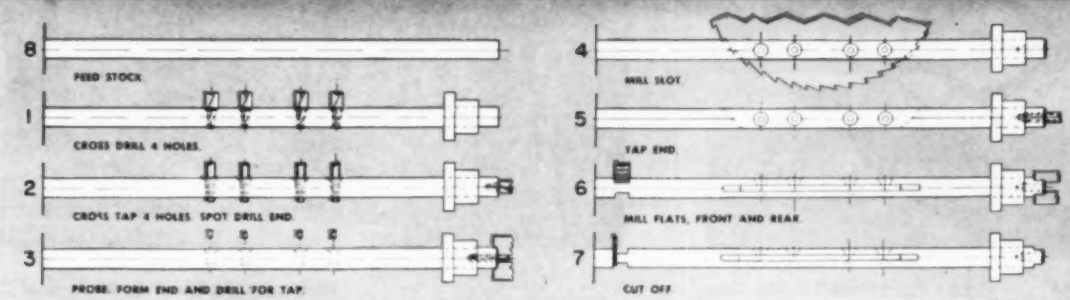
Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

16 Operations



SPEED-BAND®
the newest concept in band saw blades—made from L-100-M, a double carbide alloy developed especially for band saws. Its hot hardness and abrasion resistance effect extraordinary results.

Available only from Capewell Distributors, of course

CAPEWELL
THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Japanese steel

Dear Sirs:
On your "Spot News" page (*AM*—Mar 9 '59, p85) you ran an item about a new type of steel which is five times harder and yet five times easier to machine. As I understand it, this was a Japanese process now being licensed out.

Can you supply us with additional information and also tell us who to contact on this matter?

William Thompson
Boston, Mass

Dear Sirs:
. . . This steel process is of vital interest to us, and we would like to have the name of the company or representative so that we can investigate and learn whether it is applicable to our product.

Earl J Miller
Chicago, Ill

Our Tokyo News Bureau advises us that Tohoku University owns the Japanese patent and reserves the rights for licensing in foreign countries.

The company in Japan handling licensing for the United States is Kashimoto Shoten Ltd, 18 2-chome, Marunouchi, Chiyoda-Ku, Tokyo, Japan—Ed.

Iron Curtain blank

Dear Sirs:
In your "Metalworking Report" (*AM*—Sept 7 '59, p3) you carried a paragraph with the title, "Polish by Melting?"

Would you please send us any additional information that you might have on this subject as soon as possible?

M Pacak
Cleveland, Ohio

We are sorry to report that we do not have any additional information on the subject. Our Vienna News Bureau picked up this item from a Rumanian technical weekly, Tehnika Noua, *and has been unable to secure any further details*—Ed.

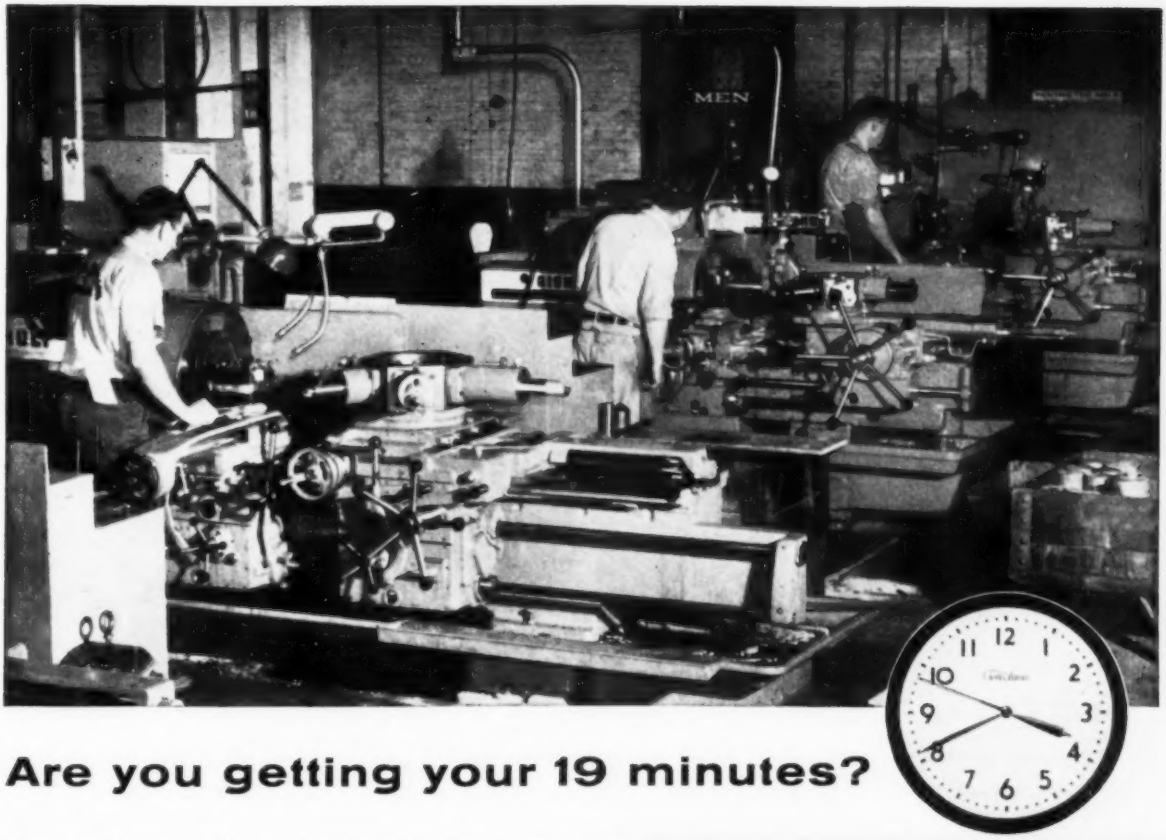
Readers identify gun tool

Dear Sirs:
The tool shown in H E Linsley's letter (*AM*—Oct 19 '59, p92) is a special wood rasp used by gunstock craftsmen in producing in-

SHOPMATES

N. Jarvis

...NOW... THIS DIMENSION, FROM HERE "CHOMP" OVER TO THE COFFEE STAIN, "CHOMP" DON'T LOOK RIGHT BECAUSE, THE TOTAL OF "FSK FSK" FROM THE MUSTARD TO "SMACK" THE JELLY AND FROM "GLUB" THE CHOCOLATE THERE TO THE DRIED UP SARDINE FIN IS "CHOMP" DIFFERENT THAN "SLURP" THE BUTTER TO THE CATSUP! "SMACK - CHOMP"!!
NO COFFEE BREAK??
...SUDDENLY... I... DON'T ... FEEL ... VERY .... HUNGRY .... !
N. JARVIS



Are you getting your 19 minutes?

Recent studies prove the average manufacturer operates at a profit *only during the last 19 minutes of every working day.*

What happens to the rest of the day's output? According to the National Association of Manufacturers, it goes to pay the costs of doing business.

Think what this means to manufacturers attempting to produce profitably with obsolete equipment... with machining unavoidably representing a large part of the manufacturing cost.

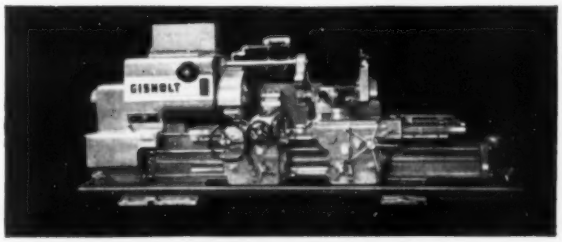
The thin line between profit and loss in your operation can well hinge on your taking advantage of modern, high-speed machine tools with ample power, reserve feeds and speeds, and maximum flexibility.

If you have obsolete equipment in your shop, now is the time to look at it closely and critically. The difference between the old and the new may amaze you. Find out now just how much obsolete machines are holding you back.

Why not call in your Gisholt Representative and talk it over with him? He'll give you fair and accurate appraisals of any machine's productive output. Call him today.

GISHOLT
MACHINE COMPANY
Madison 10, Wisconsin

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT MACHINES WITH NEW-MACHINE GUARANTEE



Gisholt MASTERLINE
Saddle Type Turret Lathe

Rugged headstock gear train provides 24 different forward speeds—all from a single-speed motor, for full power on all cuts.

Hydraulic speed selector permits effortless speed shifts without stopping spindle or shifting gears.

Here's a rugged, powerful machine that delivers maximum output and accuracy from today's carbide tools—and has ample reserve to meet tomorrow's tooling requirements.

Contact your Gisholt Representative today for full details.

Gisholt Machine Company
Madison 10, Wisconsin

☐ Send Saddle Type Turret Lathe Literature.
☐ Have Gisholt Representative call.

Name.....*Title*.....

Street Address.....

City.....*State*.....

LEADERS IN INDUSTRY MARK WITH NOBLEWEST

Above left—Tooled for marking part numbers on the I.D. of steel rings—component parts for aircraft engines.

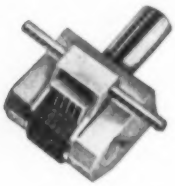
Above right—Tooled for marking aircraft engine rocker box covers.

ROLL-O-MARK'S Versatility

Speeds up metal marking

All-pneumatic Model 50P1

Whether it's an aluminum forging that requires a marking machine sensitive enough to provide a shallow mark without distortion — or the critical marking of the steel ring described above — low cost Roll-O-Mark is ideal for the job. Roll-O-Mark offers such outstanding features as — pneumatic table pressure for positive uniformity of impression — pneumatic operation of die slide — the Noblewest *roll-marking* process for producing sharp, permanently indented impressions that will last as long as the product itself . . . marking better, faster (up to 1200 pieces per hour), and at lower cost. Prompt delivery can be made on Roll-O-Mark. For specifications and prices, or comprehensive marking catalog, write Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.



NOBLEWEST Automatic Numbering Heads are standard in the marking industry. They offer unlimited applications for constant, selective and consecutive numbering. Made to the most exacting standards of quality, they are competitively priced.

A few desirable territories open to qualified representatives.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES

NOBLEWEST

ORIGINATORS OF THE ROLL MARKING PROCESS

MARKING
NUMBERING
EMBOSSING
GRADUATING

tricate cross-hatched designs on gunstocks for decoration or to improve the frictional characteristics of the gun butt against the shoulder or to improve the hand grip on the stock.

My grandfather was a hobbyist and a real artist in "checkering," the old-time name for this artistry, and as a youth I spent many hours watching him produce beautiful, intricate designs on gunstocks with tools such as this.

The particular tool shown is only one of many sizes, shapes and cuts normally used by an artisan in this profession. Most old-timers hand forged and cut their own tools. Checkering tools are still manufactured and are listed for sale in the *Shooters Bible and Gun Digest.*

Frank Benedict, *advisory engineer*
Westinghouse Electric Corp
Hyde Park, Boston, Mass

Dear Sirs:

As an amatuer gunsmith, the item in question seems to be a checkering tool—that is a tool used to cut checkering into the stocks of guns of all sorts.

The shape and style of the teeth are set up to cut hard wood. The tang, of course, goes into a handle, probably also wood.

The triangular shape lets the operator get close to borders and adjacent runs of checkering without marring the grooves already cut. You could call it a specialized form of file for wood only.

Fred Noesner,
plant superintendent
New York Diamond Tool Co, Inc
East Orange, NJ

Well, that seems to clinch it—Ed.

"Good morning, Mr. Grimshaw—I brought a written excuse from our car pool driver!"

CALENDAR

Drop Forging Association—Winter Meeting, Dec 6-9, Savoy Hilton Hotel, New York, NY.

Material Handling Institute—Annual Meeting, Dec 14-15, Savoy Hilton Hotel, New York, NY.

Joint National Symposium on Reliability and Quality Control—Jan 11-13, Statler-Hilton, Hotel, Washington, DC.

Plant Maintenance & Engineering Show & Conference—Jan 25-28, Convention Hall, Philadelphia, Pa.

Society of Vacuum Coaters—Annual Meeting, Jan 26-27, Hotel Biltmore, New York, NY.

Instrument Society of America—Instrument-Automation Conference and Exhibit, Feb 1-5, Houston Coliseum, Houston, Texas.

Society of the Plastics Industry—Reinforced Plastics Div Conference, Feb 2-4, Edgewater Beach Hotel, Chicago, Ill.

Armour Research Foundation and American Welding Society—Annual Midwest Welding Conference, Feb 3-4, Illinois Tech Chemistry Bldg, Chicago, Ill.

American Society for Metals—Golden Gate Metals Conference, Feb 4-6, Fairmont Hotel, San Francisco, Calif.

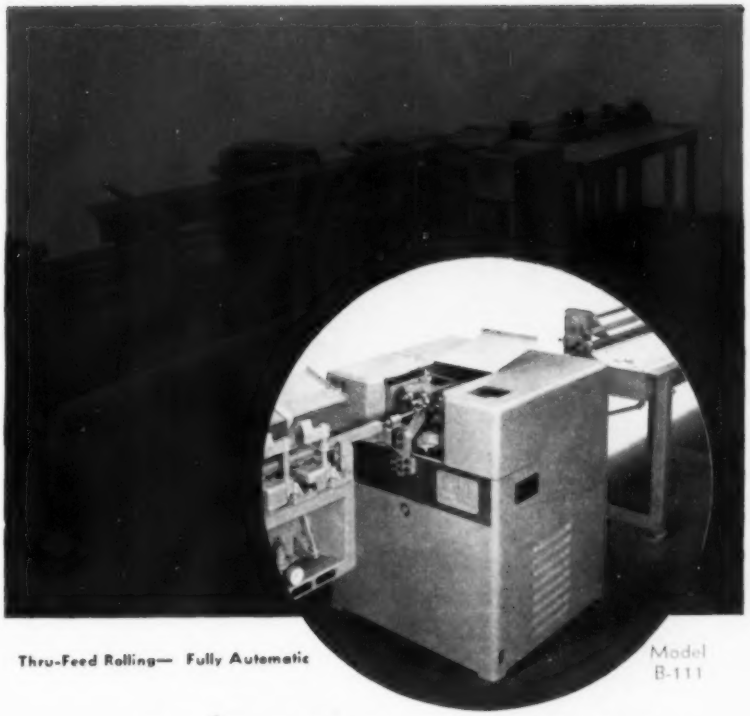
American Institute of Mining, Metallurgical, & Petroleum Engineers—Annual Meeting, Feb 14-18, Statler and McAlpin Hotels, New York, NY.

Annual Joint Conference on Automatic Techniques (ASME, IRE, AIEE)—Apr 18-19, Cleveland-Sheraton Hotel, Cleveland, Ohio.

American Society of Tool Engineers—Tool Show, Apr 21-28, Detroit Artillery Armory, Detroit, Mich.

American Welding Society—Annual Meeting and Welding Show, Apr 25-29, Great Western Exhibit Center, Los Angeles.

American Society for Metals—Southwestern Metal Exposition and Congress, May 9-13, State Fair Park, Dallas, Texas.

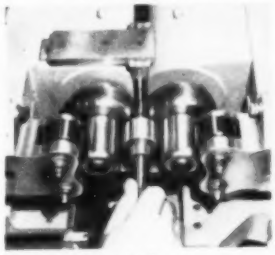


Thru-Feed Rolling— Fully Automatic

Model B-111

.... for Production or Job lot Threading and Form Rolling

In-Feed Rolling— Fully or Semi-Automatic



In-Feed Rolling— Manual loading

REED Two-Die Type Cylindrical Die Thread Rolling Machines

The flexibility of the Reed B-111 machine provides for the most economical selection of equipment to suit job lot or quantity production requirements.

Standard machines are available for in-feed or thru-feed rolling or a combination of both for a wide range of thread and form rolling applications. Precise micrometer die and work positioning adjustments assure continuous production of uniform accurate threads and forms.

Write for Machine Bulletin B-111-1

REED TRM-173

REED ROLLED THREAD DIE CO.

Specialists in Thread and Form Rolling Tools and Equipment

HOLDEN, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto

"We build diesel engines"

"We ought to be getting more output from this plant. When I spotted an ad for a turret drill press about a year and a half ago, I sold the front office on putting one in Bay 3. Right now, it's delivering more than double any drill press in the shop. This is the best proof I can give management that we ought to bring the equipment up to date."

That's the way that most Metalworking production men feel about their plants' performance. Because they supervise, plan and boss manufacturing in a $120 billion field, men like our hypothetical but typical Don O'Regan must stay current – on equipment, materials, techniques.

This is American Machinist's job. As the magazine of Metalworking's production, it's written and edited for these key men. More of them subscribe to it than any other Metalworking publication. It's consistently regarded as the "most useful" magazine in the field. That's why Metalworking production engineers and executives are quick to say . . .

"I have to read American Machinist"

McGraw-Hill Magazine of Metalworking Production
330 West 42nd Street, New York 36, New York

Presenting:

The 1959 Winners of Honor Citations

for excellence in gear production and effective use of modern gear production equipment

Michigan Tool Company
Detroit, Michigan

How the Citations were awarded...

About two years ago, Michigan Tool Company set up — as part of its own research and development activities — a committee of engineers familiar with both the techniques and economics of gear production. Prime purpose of this committee was to help guide Michigan Tool's own research and development on new methods and equipment through detailed studies of the techniques and operations at individual plants.

About a year ago, it was decided to give public recognition to those cooperating companies in industry, the study of whose operations revealed valuable progress in gear production methods and uses of modern gear production equipment.

During the past year the operations of a number of plants were studied and several of these were named by the committee as qualifying for Honor Citations.

The studies are continuing. Several additional plants have already been recommended by the committee for Citations in the coming year while still others may qualify as studies of their operations are completed.

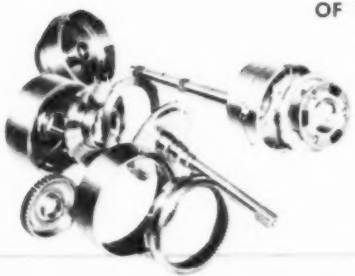
The individuals to receive the Citations in behalf of the plants were nominated by the managements of the recipient companies.

CATERPILLAR TRACTOR CO., Peoria Plant
W. L. Naumann, Plant Manager

OF SPECIAL NOTE: Excellence in selection of tooling for production of heavy duty gearing to reduce costs and increase quality. Its extensive use of shaving to produce quiet gears of greater strength for road building and construction equipment was a factor in the selection of this plant for a citation.

Gordon Swardenski, Asst. Plant Mgr., left, receiving citation from M. R. Anderson, President, Michigan Tool Co. The machine in the background is an 873 finisher for heavy duty gears.

CHRYSLER CORPORATION, Kokomo, Ind. Plant
James Cypher, Plant Manager



OF SPECIAL NOTE: The unique adaptation of the Shear-Speed gear-cutting process to the cutting of many types of tooth forms in a variety of materials — aluminum, steel, and cast iron.

James Cypher (right) receiving the 1959 Honor Award from M. R. Anderson, President of Michigan Tool Co. in front of one of the Shear-Speed gear cutting machines.

John H. Jones receiving the Honor Award from H. Pelphrey, Research Director, Michigan Tool Co.

DANA CORPORATION, Toledo Division
John H. Jones, Works Manager

OF SPECIAL NOTE: Its constant search for quality as evidenced by the quick adoption of abrasive gear finishing to improve the accuracy of hardened gears for heavy duty transmissions and eliminate any possible burrs and nicks resulting from handling of gears in process.

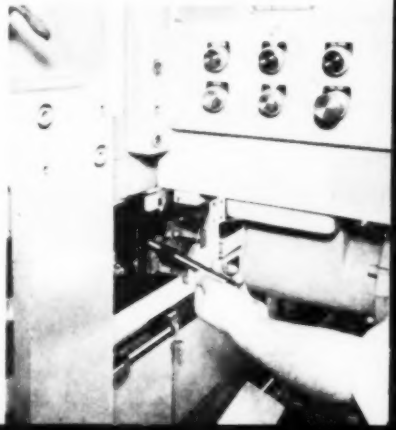
Michigan Abrasive Gear Finisher used to improve accuracy of hardened gears by Dana Corp.

C. E. Kopp (right) receiving the 1959 award in the motor boat engine field from Michigan Tool's president M. R. Anderson.

EVINRUDE MOTORS, Milwaukee
C. E. Kopp, Factory Manager

OF SPECIAL NOTE: Evinrude's vision in adapting chipless machining to the production of motor boat engines, particularly on stainless steel shafts — increasing strength of shafts and eliminating wastage of materials in the form of chips.

Rolling of involute teeth on Evinrude's stainless steel shafts on a Michigan Roto-Flo machine.



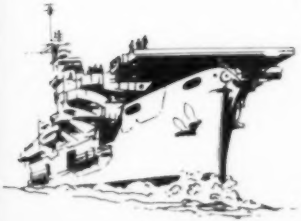
FORD MOTOR COMPANY, Transmission Division
R. L. McNulty, Plant Manager, Livonia

OF SPECIAL NOTE: The manner in which this plant has reduced the hazard of human errors in gear production through selection of high precision production equipment and mechanization of handling of gears in process as through the use of Gear-O-Mation in-process storage, feeding, unloading, orienting, and allied equipment.

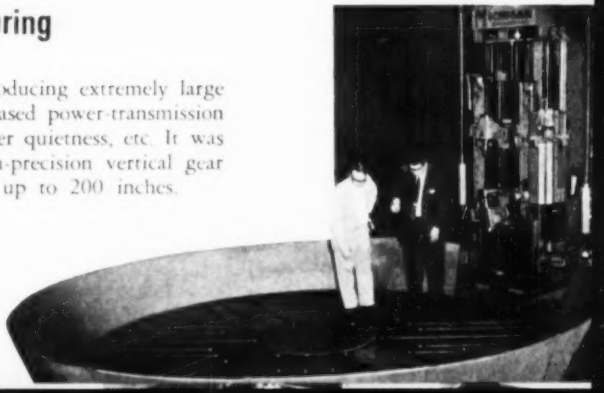
Looking over some of the Gear-O-Mation equipment at Ford-Livonia are A. F. LeFevre, Quality Control Mgr; R. L. McNulty, Plant Manager; Stanley Cenzer, Mgr. of Mfg. Engrg; M. R. Anderson (President of Michigan Tool Co.) and E. M. Sirhal, Prod. Mgr.

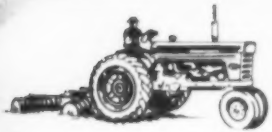
GENERAL ELECTRIC COMPANY, River Works
Jasper E. Anderson, Manager of Manufacturing

OF SPECIAL NOTE: The outstanding job done in producing extremely large gearing for ship propulsion resulting in increased power-transmission capacity for a gear of a given size, far greater quietness, etc. It was also a pioneer in the use of very large high-precision vertical gear shavers (Michigan V-series) to finish gears up to 200 inches.



J. E. Anderson of G.E. and M. R. Anderson, President, Michigan Tool Co., standing on the table of one of G.E.'s huge Michigan V-series gear finishers—capable of producing highly accurate gears of up to 200" diameter.

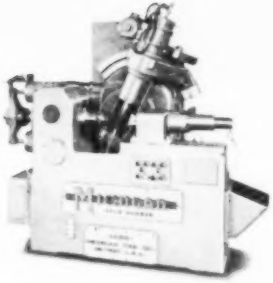




INTERNATIONAL HARVESTER, Farmall Works
Paul Bohy, General Supt. Division 2
Ernest Palmer, General Foreman, Gear Lab.

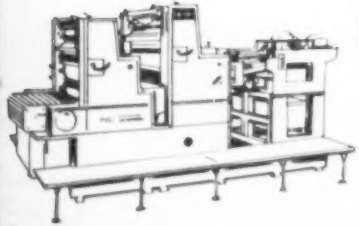
OF SPECIAL NOTE: Awarded the Citation in the tractor field, for the evidences of its constant search for equipment and methods which would reduce costs despite close tolerances. Example: Adaptation of high speed hobbing to the production of tractor gears.

(Left) Walter Rodger, Asst. Supt. and (right) Ernest Palmer, with A. D. F. Moncrieff, Michigan Tool VP who presented the awards.



A battery of Michigan 1458A high speed hobbers like this is used at the Farmall Works.

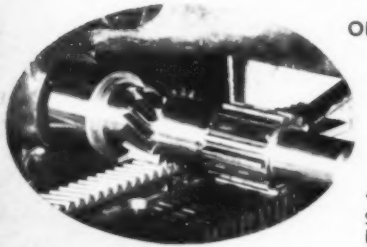
MILLER PRINTING MACHINERY COMPANY
Earl H. Sieg, Plant Manager



OF SPECIAL NOTE: The unusually tight tolerances which this manufacturer of offset printing machinery maintains on gears for offset printing equipment. Its constant checking for accuracy with the latest type of equipment.

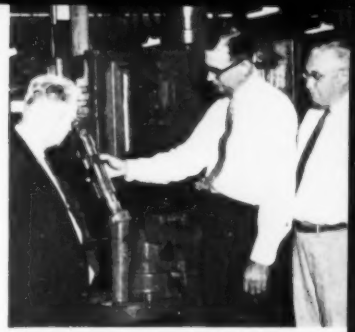
Miller Printing Machinery officials looking over recordings of 100% involute checking of gears (on a Michigan Sine-Line 1124) (l. to r.) A. A. Saul, Chairman of the Board; R. S. Hildreth (Chief Engineer of Michigan Tool Co.); Earl Sieg, Plant Manager, and W. G. Young, President. Miller also uses a Michigan 1218A optical checker for gear leads.

ROCKWELL-STANDARD CORPORATION
Transmission and Axle Division, Newark, Ohio
Wm. E. St. Clair, General Manager



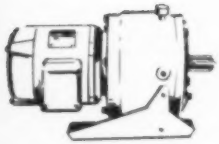
OF SPECIAL NOTE: Its continued search for gear production equipment which will result in higher quality gears at lower cost for its double reduction axles. Its use of "870" type gear shavers for a variety of gear sizes and types is an example.

"Undercut" shaving at Rockwell-Standard on the Michigan 900 helps keep gears in mesh.



(R to L) H. E. Kraning, Asst. Gen. Mgr. and Wm. E. St. Clair, Gen. Mgr. of Rockwell-Standard with H. Pelphrey, Research Director of Michigan Tool Co. looking over an unusual shaving job on a Michigan 900.

WESTINGHOUSE ELECTRIC CORPORATION, Nuttall Works
F. D. Weatherholt, Division Manager, Gearing Div.



OF SPECIAL NOTE: This home of Moduline is believed to be the first to use chipless machining on gearmotor shafts, increasing uniformity, shaft strength and finish. Noteworthy are the close tolerances, extensive use of shaving, and precision checking to assure accurate gears both in job lots and in continuous runs.

R. S. Hildreth, Chief Engineer, Michigan Tool Co., discussing "optical lead checking" on a Michigan 1218A with Mr. Weatherholt, R. H. Timmons, Mfg. Mgr., and R. L. Mathias, Engrg. Manager, of Westinghouse Gearing Division, where production gears of master gear quality are the rule.

Products and Services of "Gear Production Headquarters"

LARGE EXPERIMENTAL LABORATORY for development and pilot runs of gears and geared components as well as tooling for customers.

GEAR CUTTING EQUIPMENT: "Michigan" and "Michigan-Lorenz" hobbers; "Michigan-Lorenz" gear shapers; "Shear-Speed" Gear Shapers; hobs, shaper cutters, involute cutters, etc.

GEAR FINISHING: "Michigan" gear shaving machines; "Michigan" gear lappers; "Michigan" abrasive gear finishers (for hardened gears); gear finishing cutters and tools.

GEAR CHECKING: "Sine-Line" gear checking equipment for laboratory and production line checking and analysis of gears; "Sine-Line" hob checking equipment; "Ultradex" split-second accuracy index tables; master gears.

AUTOMATION: "Gear-O-Mation" standard and custom-engineered equipment for handling of parts in process (storage, loading, unloading, conveying, orienting, distribution, etc.).

WORM GEARING: "Cone-Drive" double-enveloping worm gearing, speed reducers and gear motors.

CONSULTING SERVICE: On all phases of gear design, tool design, processing, equipment, automation and economics of gear production.

MICHIGAN TOOL Company

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Field Engineers and Representatives in every important Industrial Center of the free world.

SPOT NEWS...

- **Metalworking will become a $375 billion a year industry by 1975**—an increase of 150% over present annual sales volume. That's the prediction of American Society for Metals President Walter Crafts, who says the $375 billion will amount to about one half of the Gross National Product at that time, compared with about one-third today.

- **The U S has 31,084 metalworking and metal-producing plants** employing 20 or more people, according to the first issue of Dun & Bradstreet's Metalworking Directory. Of this total, 11,141 have 100 or more workers, 7,111 have 50 to 99 employees, and 12,832 have 20 to 49 people. New York has the most plants—3,502, closely followed by California, Illinois, Ohio, Michigan, Pennsylvania.

- **Studebaker-Packard is considering purchase of Oliver Corp's** farm machinery and equipment producing business. Oliver ranks among the half dozen top manufacturers of farm machinery.

- **Martin Co, Baltimore, is dickering** with West Germany's Telefunken, Heinkel and Messerschmidt for pooling of technical knowledge and capital with an eye to penetrating the European market in the electronics and related fields.

- **A "concordium" of 28 U S manufacturers** has been organized to sell or trade $26 million worth of industrial equipment, type unspecified, to Russia—pending government approval (see p92).

- **Synthetic diamonds of the same wheel grade as those now marketed by GE** are being produced by DeBeers of South Africa. While DeBeers says large-scale production is now possible, it must decide whether to manufacture them or not—and the decision must be made jointly with the Belgian Congo Diamond Co, which markets natural diamonds of the same grades. DeBeers is seeking world patent rights, not now held by anyone, because GE until a month ago had a secret U S patent only. GE, incidentally, has just announced it is now able to make "blocky" shapes for metal-banded wheels.

- **At least one major automaker is interested in the radial forming process** for manufacture of one-piece car tops. The contour stretchforming process would eliminate need for ribs and other configurations in large panels. Possible other auto applications: moldings, bumpers, trim, ducts.

- **Italians have come up with** (1) a fully automatic machine that combines ultrasonic and electrical discharge machining to finish surfaces down to a few microns at a high metal-removal rate, (2) a flexible long-arm radial drilling machine, and (3) a hot ingot peeling machine that replaces conventional ingot chipping. Ingots are peeled at more than 1800 F, when metal is so malleable cutting speeds of 1640 can be used.

- **It is estimated that 787,000 automobiles will remain unbuilt** as a result of the steel strike, and $94,440,000 worth of steel which would have gone into them will go unused (see p73).

- **1970 will see 20-million more cars on the road than there are today,** bringing the grand total to 83 million, according to Chrysler's Harry E Chesebrough, who also predicts 20 million of them will be compacts.

- **Russians are meeting with less success in selling machine tools in Mexico** than is satellite Czechoslovakia. Reason is that the Czechs really get out and "ring doorbells" and their machines are better liked.

- **France's Simca, aping U S dream cars,** has come up with a bubble-canopied, bath-tub-like prototype called the "Semi-Flying Fulgar," which is reportedly controlled by an electronic brain.

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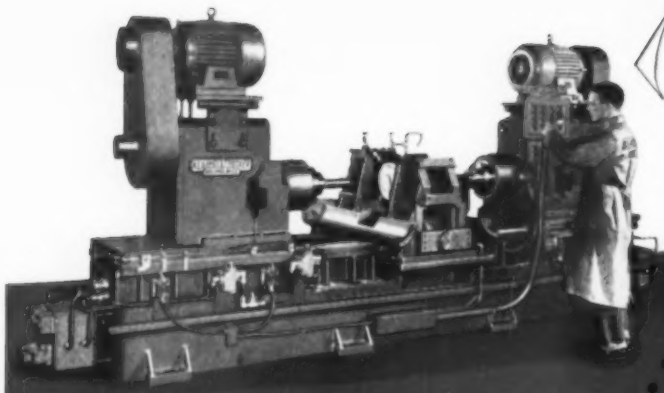


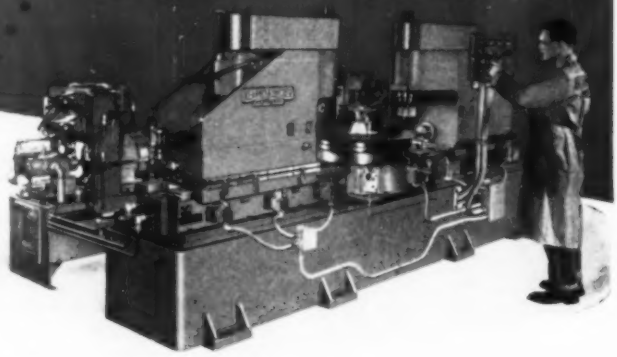
CONSTRUCTION INDUSTRY

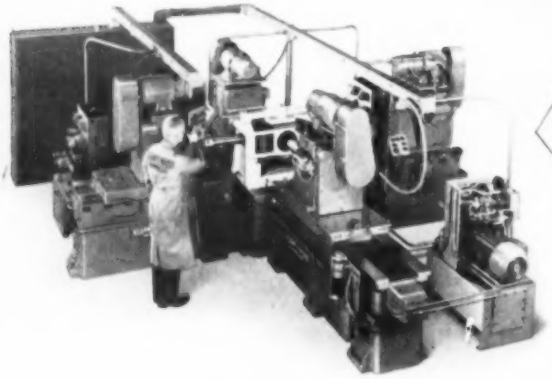
Only one setup is required to rough and finish bore, finish counterbore and face both sides of a tread roller for tractor-type construction equipment. Workpiece is hydraulically clamped . . . seven sizes of rollers can be machined. This method replaces a turret lathe using two setups. New rate is 13 pieces per hour.
Production up — 100%.

Kearney & Trecker builds PRODUCTION MACHINE TOOLS FOR EVERY INDUSTRY

AIRCRAFT INDUSTRY

Rotary feed, bed-type machine with two opposed vertical spindles mills both sides of aluminum pump body flange to critical thickness and smooth finish *at rate of 76 pieces per hour.* Unit is versatile . . . as many as eight types of pump bodies are milled using only separate fixtures and cams.





ENGINE INDUSTRY

This unit bores four holes in engine block simultaneously . . . replaces horizontal milling and boring machine that worked just one hole per setup. Interchangeable inserts allow operations on any of four different workpieces. One feed slide unit handles interchangeable heads.
Production — 10 pieces per hour . . . up — 400%.

ELECTRIC POWER INDUSTRY

Two-spindle machine mills both inside and outside radii of curved alloy steel turbine blade section in a single pass *at three times the former feed rate.* Versatile 360° drum fixture handles 81 different blade sizes without overtravel on rapid stroke for extremely short cycle time.
Production up — 300%.

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WASHINGTON...

Bargaining looks rough . . .

The winter bargaining outlook is grim. The 1959 steel strike—which seems almost certain to be resumed in late January—is just the opening thrust in a series of coming labor-management contests. Within the next few months, the bargaining rounds will take in electronic and electrical industries, communications, railroads and aircraft.

Walter Reuther and other labor leaders are already planning strategy. Reuther's Industrial Union Department is developing a "centralized" bargaining program where industrial unions dealing with the same employers or working in the same industries can plan coordinated bargaining or even strike strategy. It will be patterned after the United Auto Workers-International Association of Machinists pacts in aircraft and missile negotiations. Reuther's Auto Workers and Al J Hayes' Machinists still have to settle on winter demands, but already they are talking about emphasis on severance pay and extra vacations.

The IUD, made up of the AFL-CIO's 68 industrial unions, is making plans for a new "offensive" at the bargaining table, in organizing and on the legislative fronts.

Steel sets the tone . . .

The bitter steel dispute is setting the bargaining tone. The 116-day strike, finally halted by the Taft-Hartley Act injunction, only succeeded in freezing management and labor positions at the bargaining table. Key to this dispute is the steel industry's demand for greater control over working rules. Tnis is also present in the coming railroad negotiations; it will be a big part of the United Electrical Workers' negotiations next year with General Electric and Westinghouse.

That's why the outcome of the steel contest bears close watching. Success by management or labor would prod their allies to do likewise. There are no signs yet on the outcome in steel. If compromise is the way out it isn't yet in the works. But both sides know that if they don't settle this by negotiation by January 26 (when the T-H injunction runs out) Congress is waiting to apply compulsory strike-settling legislation to end the dispute.

Defense budget outlook . . .

The new defense budget is a secret until the formal submission to Congress, but enough details have leaked out to give you a solid forecast on upcoming military busines for metalworking industries.

Despite the fuss over cutbacks, cancellations, and stretchouts, the volume of defense business will remain high. Spending on hardware will probably total some $17 billion next year—about the same level as this year. This sum covers research, development, and procurement of planes, missiles, ships, combat vehicles, electronics, production equipment, and such.

But there will be broad shifts within each class. Aircraft production will fall below the $6-billion expenditure level for the first time since Korea. The rate of new orders (almost $7 billion this year) will dip even more.

Missile production will rise some $1 billion to a total of roughly $5 billion. This will be close to the level set for aircraft procurement.

Electronics procurement will continue to rise, wi total over $1 billion, not counting electronics lumped in with missiles and planes.

Shipbuilding will remain close to this year's $1.6-billion level, although a dip in spending is possible.

Research and development will rise slightly over this year's $2.6-billion sum.

Stabilizing through cuts . . .

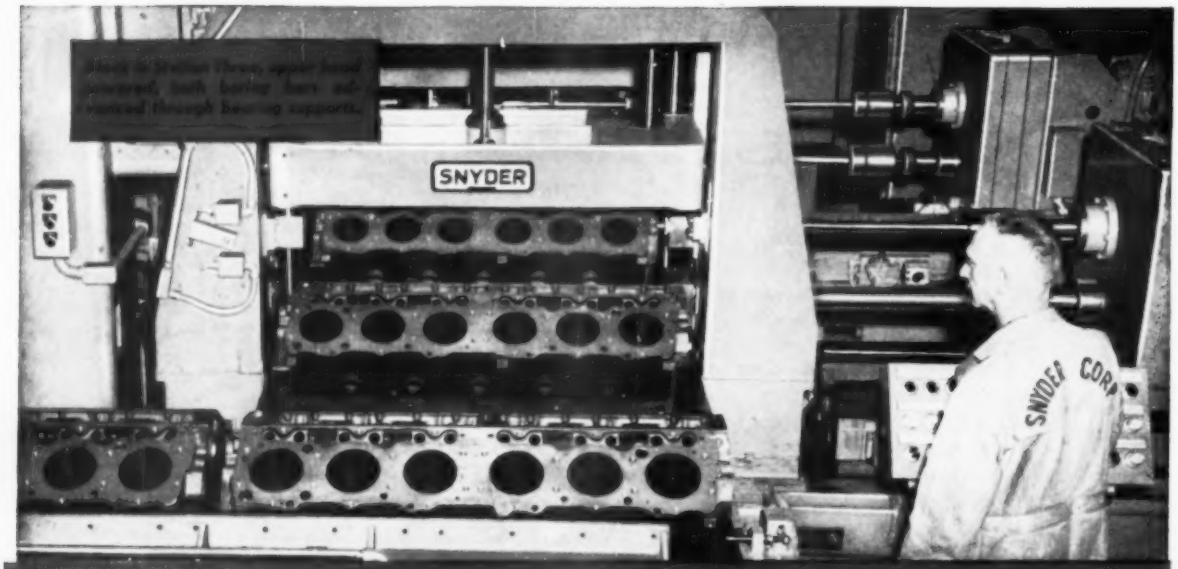
The administration's intent to hold military spending to a ceiling can be achieved only by trimming projects. Latest casualty is the Navy's second atom-powered aircraft carrier.

Congress voted $35 million to the Navy this year to start production of the reactor for a second A-carrier. The administration has decided, instead, to build a conventionally powered carrier. It costs some $120 million less than the A-carrier.

Army still plumps for Nike-Zeus . . .

As AMERICAN MACHINIST went to press, the final decision on the Army's proposal to start production of the Nike-Zeus anti-ICBM system was still unknown. But odds are strongly against a go-ahead at this time.

The new budget earmarks about $300 million to continue the project in the R&D stage. The Army asked for at least $700 million more to begin production—the money to go for purchase of machine tools and other production equipment, development of special automatic machinery to build Zeus computer components, and the like.



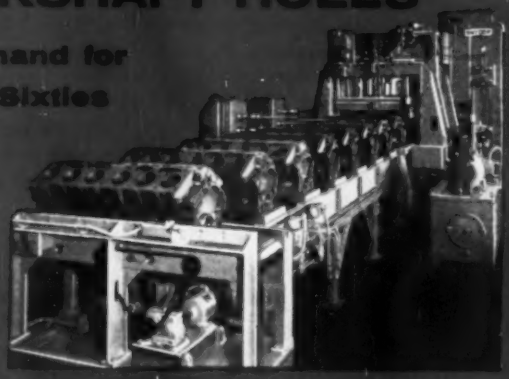
PRECISION BORING OF 42" LENGTH CAM AND CRANKSHAFT HOLES

SNYDERIZING Meets the Demand for Quality Parts for the Soaring Sixties

This 12-cylinder block is for heavy duty truck and marine engines aimed at taking a bigger bite of this booming market. Our Snyder special 7-station machine is helping this manufacturer SNYDERIZE for the Soaring Sixties by providing boring tolerances which make his product outstanding.

In regular production at a rate of 31 pieces per hour, main and camshaft bearing holes are rough and semi-finish bored simultaneously with all diameters held to manufacturers' specifications for alignment, roundness and concentricity. The distributor hole is also semi-finish bored in this machine to establish proper location to cam and crank bores.

Advanced engineering, both in product and production machines, is the best possible preparation for the competition of the next decade. We'll be happy to show you, too, how to SNYDERIZE for the Soaring Sixties to gain more efficient parts handling, gaging, assembly and machining. Write or phone for new brochure on machines for profit improvement.



Standard Features of Snyder Machines

1. SNYDER UNITS equipped with hardened and ground steel ways.
2. Building block principle throughout.
3. Automatic lubrication.
4. Walking beam transfer bar.
5. J.I.C. Standards throughout.
6. Electrical interlocks and full depth circuit throughout.
7. Panels equipped with SNYDER CIRCUIT SLEUTH.

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DETROIT...

The picture...

Taft-Hartley was invoked too late for two big automakers that normally between themselves account for over 50% of production. And no one in Detroit would officialy hazard a guess on the probability of steel solving its labor problems during this period of artificial respiration.

Chrysler Corporation began closing its eight assembly plants across the country the week of November 23. Company officials estimate that they will be down three to four weeks.

A blow much heavier came when GM shut down on November 10. 200,000 hourly workers at one time or another were home eating baked beans and awaiting steel (24 car building units alone are affected). Typical of the doleful timetable is Chevrolet, which figures that it will be dead for five to six weeks. Buick does not plan to resume assembly operations until December 14. Actually, though, the trickle of steel already in the pipelines has allowed GM to resume small scale manufacturing. Its hardware-making Ternstedt Division, the first to shut down, opened its doors again on November 16. Other manufacturing units are following daily.

Studebaker-Packard and American Motors managed to stockpile enough steel to carry them through well into December, and by that time the supply pipelines should once again be filled.

Ford will dawdle along on three- and four-day work weeks, using mostly steel produced by its own Rouge mills. Phase-out of the Edsel will divert steel to other Ford makes.

The reason...

Auto industry problems are compounded by the 7000 different kinds of steel used to manufacture the 15,000 individual parts in a typical car. Even with the mills back in action, not all of these different alloys and shapes can be made simultaneously. This steel requirement involves 50 different SAE analyses, and the pyramid to the total of 7000 varieties results from variations in thickness, diameter, length, width and quality.

The present steel pinch stems not so much from a miscalculation of the strike's length as it does from limitations of the amount of material that can be stockpiled economically. For example, commercial warehouse space costs about $3 per ton for movement in and out, plus $1 per ton per month for storage. Also, cold-rolled sheet for exterior stampings must be aluminum kilned at a $15 per ton premium to prevent brittleness from occuring during the stockpiling period.

The cost...

In terms of cars lost (which an old industry adage says can never be regained) the 650,000 units scheduled for October fell to 503,000. November output, originally programmed at 640,000, will be cut nearly in half, as will December's. And according to Ward's Reports, truck making in November will plummet to a 14-year low, with only 46,000 units on schedule.

Neglecting trucks, this means that approximately 787,000 cars will remain unbuilt as a direct result of the steel strike. Loss to the metal-producing industry is typified by the sheet that would normally be required for these cars. Each car uses approximately 1600 pounds of this material at an average cost of 7.5¢ per pound, so this totes up to a staggering $94,440,000.

The status of aluminum is problematical. Obviously automakers will not continue to stockpile fabricated parts made from secondary metal. Melt contracts, such as Reynolds has with Ford and GM, called for 24-hour production, and if the customer can't immediately absorb the output, the excess is cooled and stored as ingots—but still purchased. If these terms stick, GM for one will have cold ingots coming out of its corporate ears at Massena and Jones Mills (Ark).

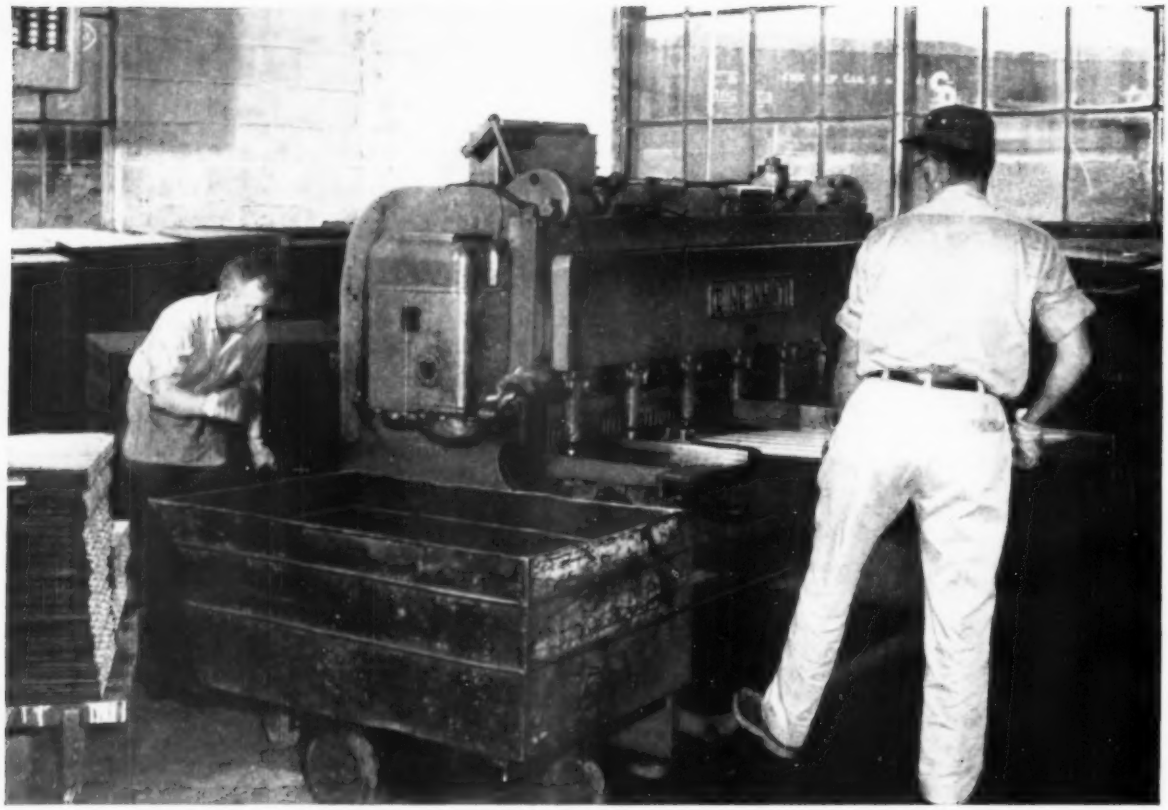
Based on average usage figures provided by Dow Chemical Co, 3,395,000 pounds of magnesium would have been used by autos if it were not for the steel strike. By coincidence, there will be the same number of tires not mounted, and therefore 8.6-million pounds of rayon tire cord will remain unspun. To pick another item at random from the industry's normal shopping list, 6.3-million square yards of vinyl upholstery material will never be sat upon.

The hope...

This is simply that adages do not apply, neglecting, of course, the very real possibility that steel workers will not have cooled off by government decree.

Just as the industry staggered, figures of most makes showed sales moving at the 1955 rate of 7.2-million cars annually. Some, including Pontiac, Rambler and Willys, were even setting all-time records. Industry fingers are crossed in the hope that pent-up consumer demand will survive the temporary shortage.

Compact cars are selling at a one-million-unit-per-year clip without even denting the standard-sized car market. Medium-priced cars, led by Pontiac, are enjoying a renascence, and the ubiquitous imports are now led by Renault.



PRODUCTION: 10,000,000 cuts
MAINTENANCE COST: $896.00

This Cincinnati® Shear has been in constant service for ten years, cutting 18-gauge corrugated sheet, 1010 draw quality, for a prominent heating equipment manufacturer at an average rate of 4000 cuts a day. That adds up to more than a million strokes per year — or 10,000,000 strokes in ten years.

Accuracy has always been excellent. The machine has been "down" *only for blade changes.* Special blades are used in this operation, to eliminate distortion of the corrugations.

Cost of machine maintenance, including blade resharpening, has been $896.00 for the entire ten years. "This," says their production manager, "to my way of thinking, is very good performance." We agree. Yet this is not exceptional. Every Cincinnati® Shear is built to provide this kind of dependability and low maintenance, and we have hundreds of case histories to prove the point.

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AIRCRAFT and MISSILES... TRENDS

Steel shortages and defense . . .

Assuming that America's first line of defense today is the aircraft and missile industry, all the recent talk about the steel shortages seriously hampering national defense must be taken with a grain of salt.

Witness this report from the chief of AMERICAN MACHINIST's Los Angeles Bureau:

"I can find no major effect of the steel strike on the aircraft and missile industry. Aircraft firms point out that their use of steel isn't particularly heavy—their biggest requirement being for aluminum alloy.

"Of four major aircraft and missile firms here, only one reports a shortage, and that on only one contract. Electronic firms report no difficulties, because they aren't heavy users of steel. They have a low poundage rate per dollars of sale."

Dyna-Soar launches new trend . . .

The Air Force contracts to Boeing and Martin for development of the Dyna-Soar manned boost-glide space vehicle represents a sharp departure from USAF management policy in such projects as the B-58 and B-70 bombers and the Atlas and Titan ICBM.

The new contracts play up USAF's intent to take on more direct control over development projects—preparation of specifications, selection of subcontractors, and the like—than it has exercised before.

Up to now, management has been centralized in the hands of prime industrial contractors, for the most part. In Dyna-Soar, USAF's Wright Air Development Division, rather than an industrial contractor, will act as system manager.

A team headed by Boeing and consisting of Aerojet-General, Chance-Vought, North American Aviation, Ramo-Wooldridge, and General Electric has been competing since June 1958 for the Dyna-Soar contract against a Martin-headed team made up of Bell Aircraft, American Machine & Foundry, Bendix Aviation, Goodyear Aircraft, and Minneapolis-Honeywell.

The Air Force took the unusual step of awarding separate prime contracts (actually final negotiations are still under way) to Boeing and Martin. Boeing will design and build the vehicle. Martin will produce the rocket launcher.

Both companies have been directed to select producers for major sub-systems and components "on a competitive basis regardless of previous working relations" that existed while the companies worked up their project proposals.

A top-level Air Force official says Dyna-Soar "could be ready in eight years—provided we get adequate funds." The project's budget this year totals $53 million. Its outlook for next year is clouded by the Pentagon's latest economy drive.

The Air Force's new policy of tighter supervision over development projects is also exemplified by the recent selection of Northrop as guidance subcontractor for the GAM-87A air-launched ballistic missile (ALBM).

Douglas Aircraft, which has the prime contract, bid on the project with a team of companies including GE handling the guidance subsystem. USAF said no on GE, directed Douglas to hold open competition for selection of a guidance designer and builder. Northrop was picked from nine electronics companies.

Radial draw forming . . .

Representatives of the Defense Dept, the three Services and NASA saw what radial draw forming can do in the making of complex aircraft and missile sections earlier this month at the Solon, Ohio, plant of Cyril Bath Co.

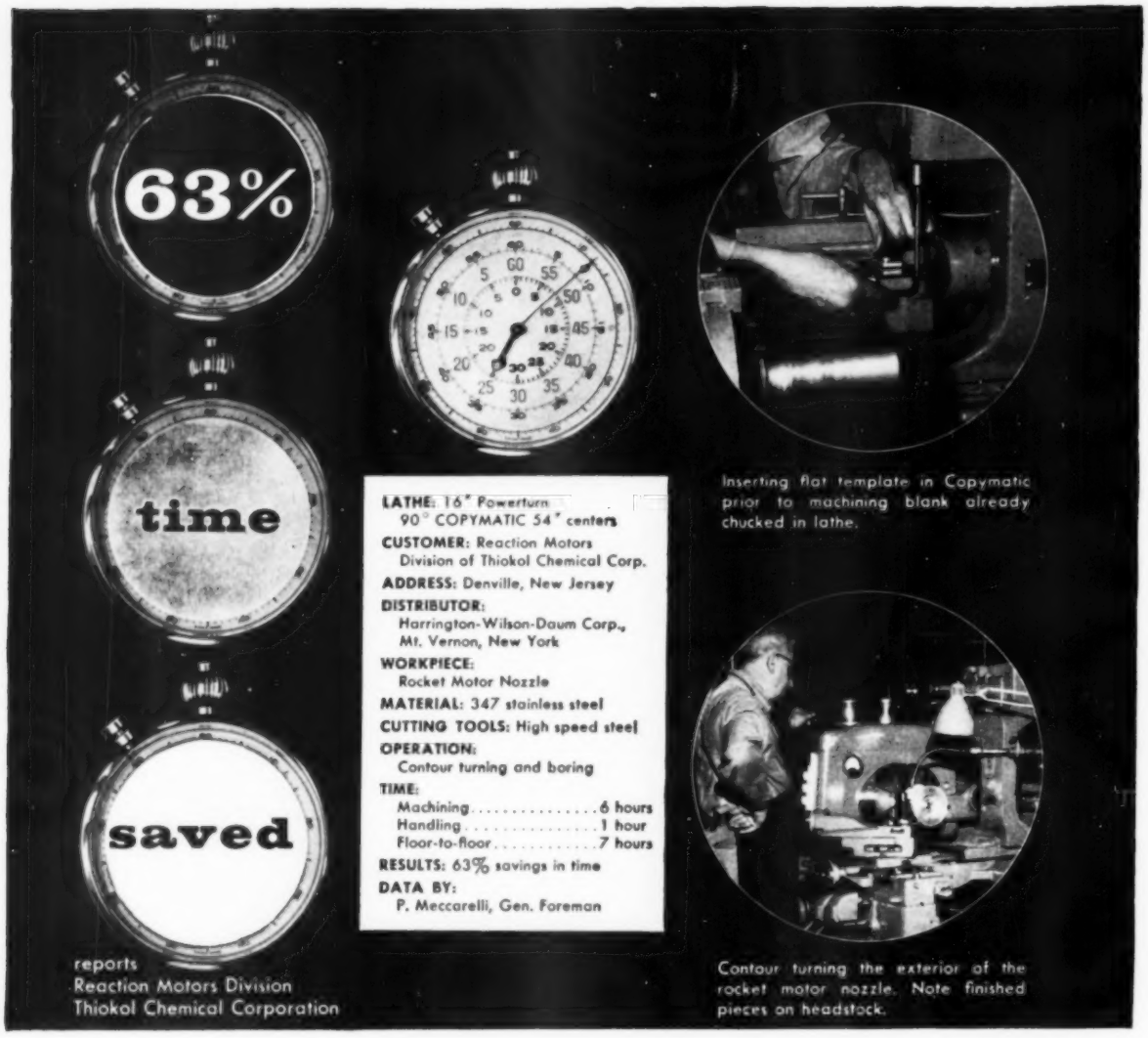
Essentially, the process (which isn't new) consists of wrapping sheet metal around a die mounted on a revolving turntable—much as you would wrap a chicken in aluminum foil. A compression shoe presses the metal against the die face to form special contours.

Cyril Bath, which makes radial draw formers ranging from 5 to 300 tons capacity, demonstrated actual production runs on the machines. For instance, a 25-ton machine produced 75-A titanium parts for DC-8 jets—and scrap losses ran to less than 0.5%.

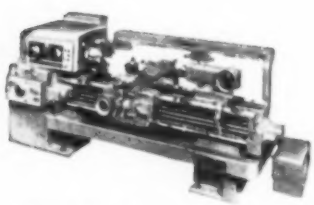
Another 25-ton machine formed A-286 stainless sections for a jet engine component at high production rates. Also formed by the radial draw process were large extruded sections for Marine Corps pontoon boats—to extremely complex curves, including twists, and without collapse.

Bath claims one of the chief advantages of the process for aircraft and missile applications (where superalloys are used) is the need for only low pressures, because small amounts of metal are moved at a time. The technique also eliminates working high-alloy materials beyond their yield points. Also eliminated are distortion and secondary manual operations. And tolerances can be closely controlled.

According to Cyril Bath officials, a 15-ton radial draw former can easily replace a 1000-ton press.


63%
time
saved
reports
Reaction Motors Division
Thiokol Chemical Corporation
LATHE: 16" Powerturn 90° COPYMATIC 54" centers
CUSTOMER: Reaction Motors Division of Thiokol Chemical Corp.
ADDRESS: Denville, New Jersey
DISTRIBUTOR: Harrington-Wilson-Daum Corp., Mt. Vernon, New York
WORKPIECE: Rocket Motor Nozzle
MATERIAL: 347 stainless steel
CUTTING TOOLS: High speed steel
OPERATION: Contour turning and boring
TIME:
Machining ..... 6 hours
Handling ..... 1 hour
Floor-to-floor ..... 7 hours
RESULTS: 63% savings in time
DATA BY: P. Meccarelli, Gen. Foreman
Inserting flat template in Copymatic prior to machining blank already chucked in lathe.
Contour turning the exterior of the rocket motor nozzle. Note finished pieces on headstock.

by this Lodge & Shipley Powerturn Copymatic Lathe



A pioneer in jet propulsion, Reaction Motors Division of Thiokol Chemical Corp., Denville, N. J., plays an important part in America's rocket defense and space exploration programs. In turn, and in turning, a Lodge & Shipley POWERTURN COPYMATIC plays an important part in rocket motor production.

In contour turning and boring a typical reaction motor nozzle, the COPYMATIC cuts 12 hours from the previous time, completing the job in 6 hours machine time and one hour handling time.

Whether you're machining the new and tougher alloys or the old stand-by metals, you'll appreciate the strength, rigidity and extra power available in Lodge & Shipley Lathes. For special jobs or routine operations, the speed and accuracy of these world famous lathes offers much to virtually any lathe user.

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MACHINE TOOLS... TRENDS

Bliss gets big order . . .

A major automotive maker, believed to be Fisher Body Division of General Motors, has just ordered three automatic production lines consisting of 20 rolling bolster presses from E W Bliss Co.

Each line consists of a double-action draw press, a single-action spanking press and five secondary operation presses. All the presses, ranging from 600 to 800 tons in capacity, are of under-drive design.

Bliss also has received an order from the same customer for 18 cloverleaf welding presses as well as for two top-drive blanking presses.

The entire order, placed presumably by Fisher Body, adds up to $4 to $5 million.

The double-action presses feature a two-speed clutch for fast approach to the work, slow draw and quick return or for operating at two different continuous speeds. Construction basically consists of two clutches mounted in tandem on one end of a shaft with a brake on the other end.

This design was first incorporated in double-action presses by Bliss in several large machines now being built for a major French automaker.

Technological changes force buying

The Bliss order, together with some other press sales to automotive companies, spotlights the fact that technological changes in press design and use, resulting in much greater productivity and cost-saving, are forcing Detroit to enter the market for new large draw presses.

Orders recently given to press builders are reported to be the first stage of a program to reequip automobile stamping plants, which were pretty much modernized as recently as 1955. A second round of orders is expected as soon as car makers have evaluated the market for compact cars and completed plans for additional compact cars in price brackets above the Ford-Chevrolet level.

Objective of the reequipment program are: 1) to cut die change time 5 to 6 hr by means of the rolling-bolster concept which permits die changes in the matter of minutes; 2) to increase output, with presses running at speeds up to 25% greater than those installed four years ago.

Automotive executives are aware of the necessity for having more of the job-shop type of press operation than before, because of shorter runs necessitated by the introduction of compact cars plus the numerous models of regular-size cars. Thus the over-capacity supposed to exist in automobile stamping plants no longer exists, thanks to changing car-production requirements and improved press designs.

Lapointe to sell British machines . . .

Lapointe Machine Tool Co, Hudson, Mass, will market in the United States through a new subsidiary, the Lapointe Machine Co, the products of five British machine tool builders.

It will sell Churchill precision surface and internal grinders (Churchill Machine Tool Co Ltd); Lang large surfacing, boring, profiling and screw-cutting lathes (John Lang & Sons Ltd); Ward capstan and combination turret lathes (H W Ward & Co Ltd); Parkinson milling machines and gear planers, including the "Gearbur" for deburring spur and helical gears (J Parkinson & Son Ltd); and Butler planers, shapers, slotters (Butler Machine Tool Co Ltd).

These five companies have for many years marketed their products through a jointly-owned and operated subsidiary, Association of British Machine Tool Makers Ltd. But until now ABTM has not been active in the U S market.

Lapointe will sell the British machines through its own direct sales staff, accounting for 80% of Lapointe's sales) plus distributors. The nameplate of each machine will carry both the Lapointe and British builder's names, such as "Lapointe Churchill." Every British-made machine will be checked by inspectors from Lapointe's British plant before it leaves the plant of the maker.

Machines of all five lines will be set up for production, demonstration and instruction at Lapointe's plant at Hudson, Mass. Replacement parts will be stocked there too, as will blueprints for production of parts not stocked in this country but needed in an emergency. Lapointe states that its own service and engineering resources will back up each British machine.

Italian, Japanese industries boom . . .

The Italian machine tool industry admits that it is booming. It has been almost unaffected by the recession and this year will ship $60 million, about $25 million of which will go abroad.

Increased trend toward automation and significant price advantages over competitors are two of the factors contributing to the boom.

Japanese machine tool industry is in the biggest boom in history. Output this year should be $60 million, with backlogs at 6-8 months and up to 14 months on elephant tools.

"You can do a better job with Stainless Steel"

SAYS HARVEY ANDERSON, VICE PRESIDENT OF SALES,
PREWAY, INC., WISCONSIN RAPIDS, WISCONSIN.

"We began featuring Stainless Steel back in 1952 when we discovered it was the finish most desired by the consumer. Built-in appliances are a permanent installation . . . Stainless Steel is a lifetime metal. They sell together, naturally.

Our production men found that Stainless Steel isn't difficult to fabricate but it's different from other types of metal, so it sometimes requires different handling. Mainly, it's just a matter of taking your time . . . and learning the right way to do the job."

For more information on the fabrication of Stainless Steel, write for the free "USS Stainless Steel Fabrication Book." United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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USS

MATERIALS...

Effects of the strike...

At less than 95 million tons for 1959, steel production will be relatively poor. There is, however, one small consolation. It assures a record-breaking production year in 1960, with output reaching at least 125 million tons. Operations at 95% of the industry's capacity will be required for at least the first six months of 1960 just to rebuild customer inventories to normal levels. (Production under the T-H injunction will not get high enough to build any significant inventory—or even to supply all of the back orders.) If output in the Spring is slowed by local labor troubles, or by freeze-up-caused ore shortages, near-capacity production may be required well into the summer. You can safely anticipate operation at over 80% capacity all next year.

People unemployed by lack of steel this year may be working overtime next year to meet the demand for products. The shortage of steel has pushed forward the dates by which key industries, such as auto and capital goods, can reach peak production. And the unsatisfied demand raises the sights of marketers and producers. A prolonged period of high activity in steel itself, and in most other durable goods industries that are trying to satisfy demand and rebuild inventories, adds strength to the 1960 outlook. Demands for quick deliveries will be heavy and customer relations are bound to be seriously strained in many places. Early, intelligent ordering will pay off. Quasi-distributors, competitive materials, foreign suppliers—all will be in the race pushing hard to fill gaps.

1960 could be the best year ever—but the strike won't eliminate the likelihood of some readjustment in business later on. In fact, its temporary extra thrust may make that readjustment somewhat more painful when it comes—a higher peak, a sharper drop.

No substantial inflation should result in 1960, from the steel strike or the eventual wage settlement. While the steel companies' plans regarding prices are not known to us, we suspect very little increase is anticipated. For many steel products there is already substantial competition from aluminum, cement and plastics. In other cases, such as sheet steel for consumer goods, competition at the retail level is so keen that the fabricators will probably have to absorb any higher cost of materials. Manufacturers who raise prices during the temporary shortage may pay dearly for the profit later on. And enough durable-goods makers recognize this danger that a parade of price increases is unlikely.

Oriented graphite...

Called "Pyrographite" by its developer, Raytheon Co, Waltham, Mass, oriented graphite now is available in commercial quantities. Because of its highly oriented crystal structure, this material offers unique high-temperature characteristics which may solve many space-age problems. Thermal and electrical conductivity are strongly anisotropic (directional). Heat flows 500 times better in a plane parallel to the surface than at right angles to it.

Other valuable properties are high density and impermeability to gases. In one direction Pyrographite has a higher heat conductivity than copper, while at 90° to this direction its conductivity is lower than that of many insulating ceramics. Also, the thermal conductivity of ceramics tends to increase at elevated temperatures whereas the oriented graphite continues to decrease for the high-density form.

Graphite, which sublimes at 6350 F (goes directly from solid to vapor) has the highest temperature limit of any element. The anisotropic form, long produced in laboratory quantities and as a thin coating on a hot filament, has five times the strength of normal graphite above 2000 F.

Cellular coatings...

To protect the hands of operators from high temperatures, Rock Island Arsenal has developed cellular plastisols for coating metal handwheels. Plastisol was used because of its many individual air cells, which act as thermal barriers, and its ability to get around a heated item.

Rubber-like tin compound...

Tin compounds that stretch like rubber and can be vulcanized were described by Dr J C Montermoso, chief of the Elastomer Branch of the Quartermaster Research and Engineering Command, Natick, Mass. Key element of the new elastomer is tin as a substitute for carbon, the usual base of natural and synthetic rubbers. The new material is called alkyl tin methacrylate polymer. While inferior to conventional rubber with respect to tensile strength and stretching qualities, the new material is more resistant to chemical fuel and suggests a "stretchable" high-temperature material. It may be the beginning of a series of carbon-replacement materials similar to the boron chemical fuels.

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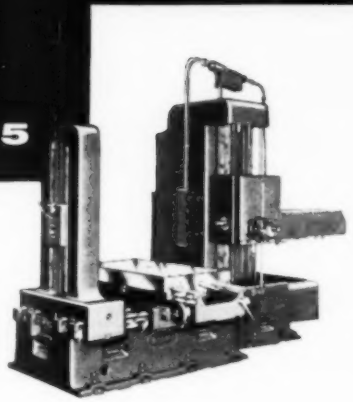
. . . with a BULLARD

Horizontal Boring Machine • Model 75



The Gas Turbine Department of the General Electric Company, Schenectady, N.Y., recently installed a Bullard Horizontal Boring Machine, Model 75. We are confident that they got more for their money.

This "*MORE" includes: —

GREATER RIGIDITY — heavier cuts at higher speeds.

PRECISE ACCURACY — hold boring tolerances to .0005.

TABLE OUTBOARD SUPPORTS — provides work alignment even with unbalanced table load.

PENDANT CONTROL — full machine control from position most advantageous to operator.

CHROME HARDENED WAYS — on Bed and Saddle for longer wear.

BED LEVELS — built into Bed for easy checking.

FAST SERVICE — after two years of operation, little trouble, and minor complaints handled promptly.

Investigate and compare and you, too — will discover you get more for your money with a Bullard H. B. M., Model 75.

ASK YOUR BULLARD SALES ENGINEER OR WRITE FOR FULL SPECIFICATIONS TO . . . . . .

THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

WHAT'S AHEAD... in Metalworking

TRENDS

A lull in the storm?

Steel operating rates are now said to be well over the 70%-of-capacity mark, but that's no reason for steel-hungry metalworking firms to believe that all will be rosy in the steel situation.

For one thing, that 70% represents melting rate. It will take from four to six weeks for a heat of steel processed today to come off the end of a metalworking line as a useable product.

Not only that, the 80-day Taft-Hartley injunction isn't changing the minds of either the steelworkers or steel management. It's almost a foregone conclusion that the strike will resume as soon as the injunction ends. Only government pressure could tip the scales.

Meanwhile, what kinds of steel are being produced and who's getting it? The mills flatly refuse to say which types are getting priority. To do so would be to antagonize those firms that want other kinds of steel. Actually, the mills are trying to bring as divergent a steel mix into supply as possible.

But "hardship cases" will get priority from some suppliers—and it looks as though the auto industry falls into this category, as does the appliance industry and possibly the farm equipment and other consumer industries.

But no mill is going to shut any type of customer out completely, because as the steel people themselves put it, "We want to cause as few hard feelings as possible."

Some mill customers have already received shipments, but these were of material already in process which was quickly finished.

Availability will depend upon type. Flat-rolled products, particularly hot-rolled sheet, will be one of the first, while products requiring more finishing will take longer to get to customers.

Aside from the distinct possibility that the steel strike will be resumed is the chance that the price of steel will go up after a settlement. Ordinarily this would cause stockpiling among consumer industries as a hedge against rising prices. This time there won't be enough steel to do so, however.

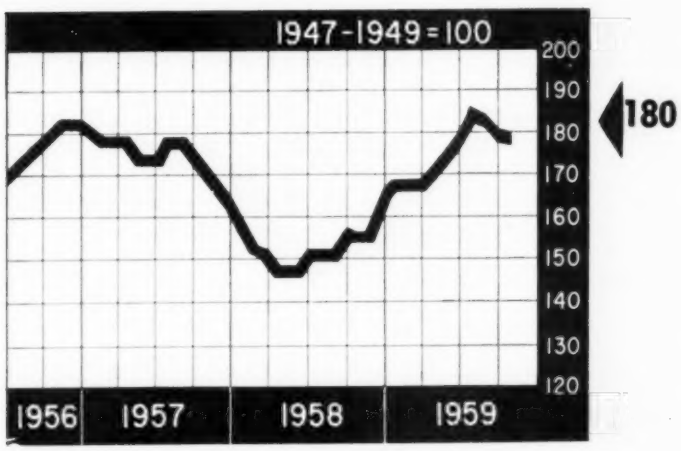
Meanwhile, steel warehouses report they are down to maybe 40% of pre-strike inventories. All kinds of sheet and the popular bar shapes are gone. Some specialty steels are reported to be still available.

Many manufacturers are desperate enough to pay two to three times the normal price for certain hard-to-get types of steel. Fortunately, even the gray marketers can't get hold of enough themselves to make much profit.

Meanwhile, stretchouts and layoffs continue, with the auto, appliance and farm equipment industries probably hardest hit because of the huge amounts of steel they need to keep going.

The aircraft and missile industry is hardly affected at all, primarily because the light metals are its principal materials. And those shops that turn out short-run specialty products are little affected by the shortages. The booming electronics industry falls into this category.

But the mass-production industries far outweigh the specialty shops on the AMERICAN MACHINIST Index of Metalworking Production and the Index can be expected to drop steadily until well into first quarter 1960.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

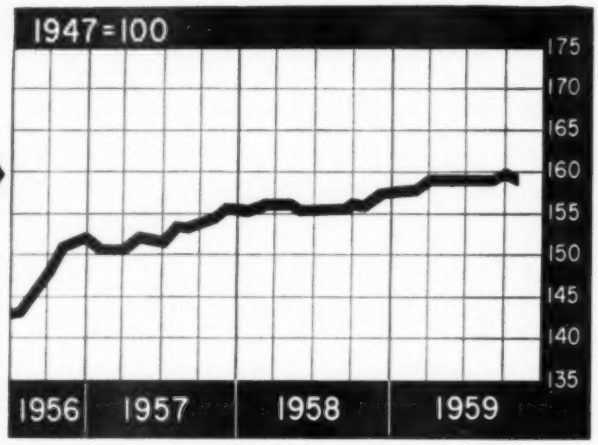
	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**180**	**182**	**183**	**155**
Machinery	156	157	130	
Electrical Machinery	233	233	180	
Autos	133	129	92	
Other Transportation	331	338	340	
Other Metalworking	153	155	140	

◀ CIRCLE 223 READER SERVICE CARD

TRENDS WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**159.5**	**159.5**	**159.7**	**156.3**
Metalworking Machinery	...	188.7	187.9	181.6
Other Machinery exc. Electrical	.	171.6	171.5	166.5
Electrical Machinery	...	162.4	162.5	158.8
Fabricated Metal Products	.....	148.3	148.8	146.7



Backlogs pile up...

The backlog of business in manufacturing industries has risen substantially in recent months. The total value of all manufacturers' unfilled orders rose above the $51 billion mark in September. For durable goods products alone, unfilled orders in September came to almost $48 billion.

The backlog of orders for durable products was more than $4 billion greater than in September of last year. And heavy backlogs mean good business in months ahead.

In durables, most of the unfilled orders have piled-up in the primary metals industries, where labor troubles in recent months interrupted output and deliveries. But the backlog of machinery orders has also increased since mid-year, and is well above the level of a year ago.

Many manufacturers are now able to clear unfilled orders more rapidly than in the past, a recent McGraw-Hill survey shows. Greater capacity and more standardized products now permit machinery makers to fill new orders in less than 4 months, on the average. Thus, in many industries, unfilled orders are now a less effective cushion when business falls off. A steady volume of business in future months, therefore, depends on a steady volume of new orders.

New orders for most durables have held at high levels in recent months, despite the drop in overall industrial production brought on by the steel strike. Machinery new orders in September jumped to a level $1 billion higher than the mark of 12 months earlier.

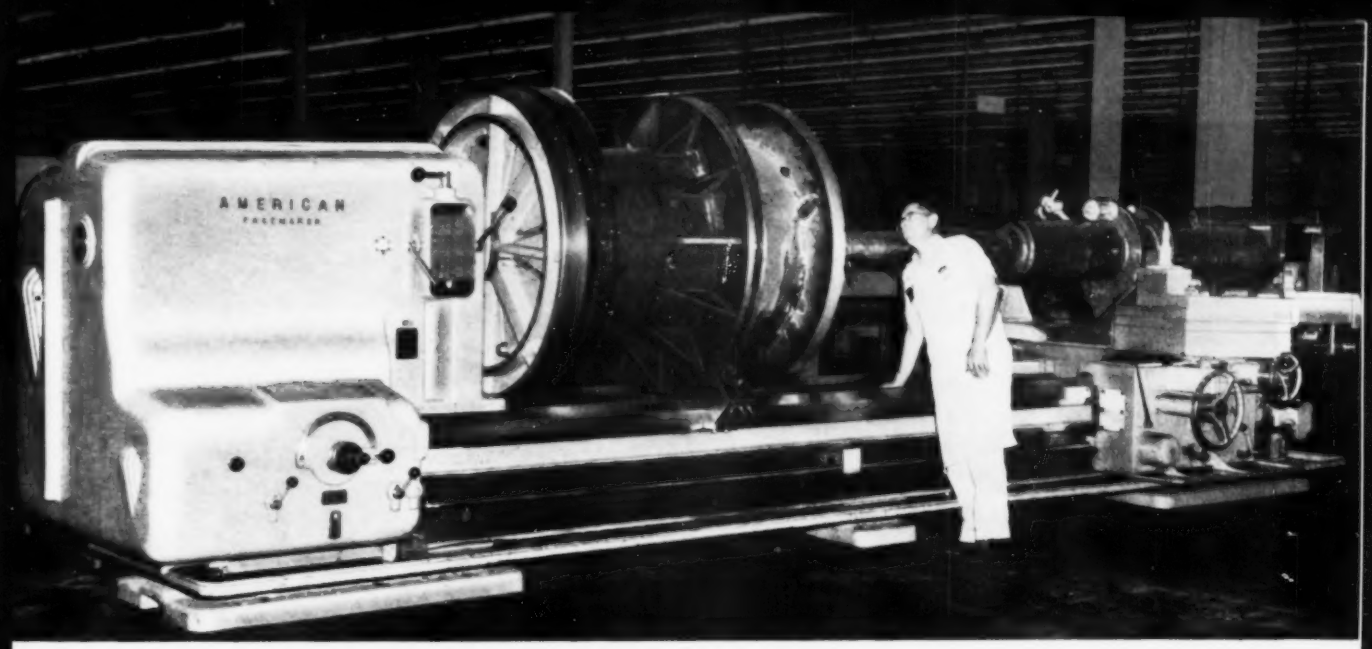
Most durable goods producers should see a rising volume of new orders in the months ahead. The big increase in capital expenditures indicated for 1960 by the McGraw-Hill fall survey means rising new orders for capital goods producers. The McGraw-Hill Machinery New Orders Forecast shows a sharp rise over the next few months.

The backlog of orders thus should give output a healthy boost in months ahead.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	140.5	141.1	136.9
Steel ingot operation (thousands of tons)	2,233	1,266	2,000
Electric power output (million Kilowatt hours)	13,270	13,019	12,378
Production of automobiles and trucks	64,668	63,451	117,688
Engineering construction awards (Eng. News-Record—millions)	$372.1	$444.3	$243.0

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	148	149	138
Index of durable manufactures production (1947-1949=100)*	157	158	146
Durable goods manufacturers' sales, millions*	$14,115	$14,008	$12,723
Machinery manufacturers' sales, millions*	$ 4,698	$ 4,651	$ 3,999
Durable goods manufacturers' new orders, millions	$15,018	$13,974	$12,859
Machinery manufacturers' new orders, millions	$ 5,211	$ 4,623	$ 4,242
New Orders for Nonelectrical Machinery (1950=100)*	181.7	159.1	161.0
New Contracts for Industrial Construction (1950=100)*	170.7	164.9	76.2

* Seasonally adjusted



HERE'S THE *VISUAL* ANSWER!

Any question about the capacity of "AMERICAN" Lathe Spindle bearings or the stiffness of "AMERICAN" Spindles is certainly answered by this illustration.

Here is a 40" "J-9" "AMERICAN" Deluxe Model Hydraulic Duplicating Lathe (one of three, 40" "J" "AMERICANS") in the Charlotte, North Carolina plant of the Douglas Aircraft Company, Inc., boring a 54" diameter bulge die weighing five (5) tons. This illustration shows an ingenious roller rest made by Douglas but on many operations no steady rest is used.

This is a 60 horse power lathe with spindle and spindle bearings of tremendous capacities, consequently is ideally adapted to "elephant" operations of this nature and there are other exclusive design features contributing to the excellence of this big lathe, such as the extremely rigid 4-vee bed; the brand new massive 7½" diameter spindle tailstock; the patented three bearing, triple drive spindle; its 100% anti-friction construction and full automatic oiling.

The many ultra modern and superlative features of "AMERICAN" Deluxe Model Pacemakers are described and thoroughly illustrated by bulletin No. 150. May we send you one?

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American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING • ESTABLISHED 1877

Too Much Capacity For What?

It has become commonplace to speak of American industry as having too much capacity. The figures seem to prove it.

Take Metalworking. Plant facilities are reliably reported to be three-fourths greater than at the beginning of the 1950s. Around $19 billion has been spent during the present decade for new plant and equipment.

Sounds as though a moratorium . . .

should be declared on further construction of new production capacity. But before that is done, suppose we ask a pertinent question: We have too much capacity for what?

Let's try to answer the question in terms of the automobile industry. It is reputed to be able to turn out nine to ten million cars a year in its present plants. What kind of cars?

The Big Three have just introduced compact cars. But they have tooled up to make Corvairs, Falcons and Valiants in only limited volume. If these cars catch on, Chevrolet, Ford and Chrysler will have to buy a lot of new equipment.

It is not just a matter of . . .

getting more machines that are tooled for manufacture of compact cars. It also is important to secure the most up-to-date tools that can do a manufacturing job at the lowest cost. For the first time in many years, and thanks partially to foreign competition, Detroit is becoming car-price conscious.

Look at Fisher Body. Only a few years ago it completed a massive program of expanding its production facilities and installing the newest presses. You would think that it had enough capacity for the next ten years. But observe what's happening. Fisher Body has just decided to invest new millions for still newer presses.

Why? Because changing times have proved that figures on capacity don't always tell the whole story. The increasing numbers of sizes and types of cars on the market are leading toward a job-shop operation with shorter runs and more frequent die changes. Hence it pays Fisher Body to get the kind of capacity that it needs today and tomorrow and to discard yesterday's. The 1959-designed big presses produce much more than the 1955 presses do and die changes can be made in a fraction of the former time.

And then there is Rambler . . .

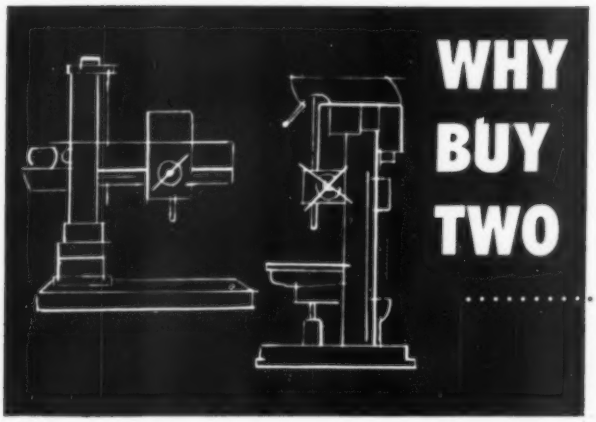
It has caught on in a big way. There may theoretically be too much plant and too much equipment in the automobile industry, but not for Ramblers. So American Motors is in the process of remedying the shortage by adding new facilities.

The situation in the automobile industry is not unique. It extends into every segment of Metalworking—farm implements, household appliances, heavy industrial equipment, scores of consumer goods. There is an abundance of facilities in general. But not enough capacity for the "hot" products.

There may be too many facilities with overage, outmoded, obsolete, high-cost machinery, but not enough equipped with low-cost, high-production machinery turning out precision products meeting today's exacting standards.

Let's not fool ourselves by thinking in terms of Metalworking's having too much capacity. Whenever your mind turns to such thoughts, ask yourself: Too much capacity for what?

Burnham Finney EDITOR



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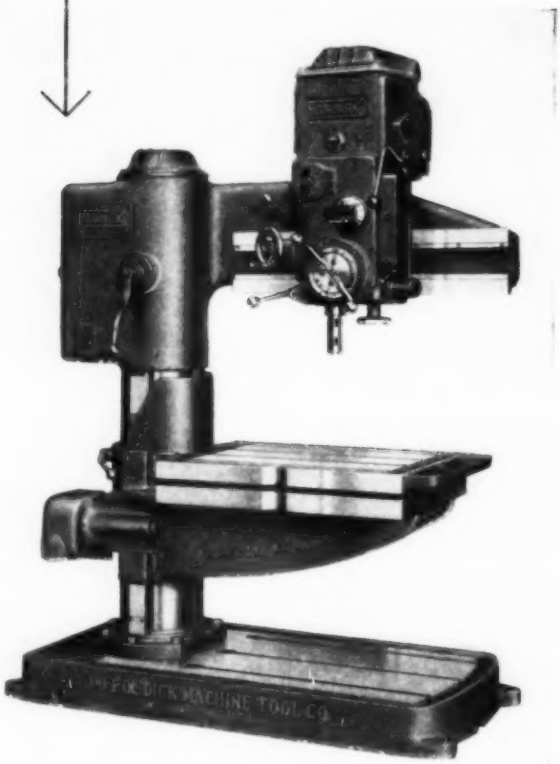

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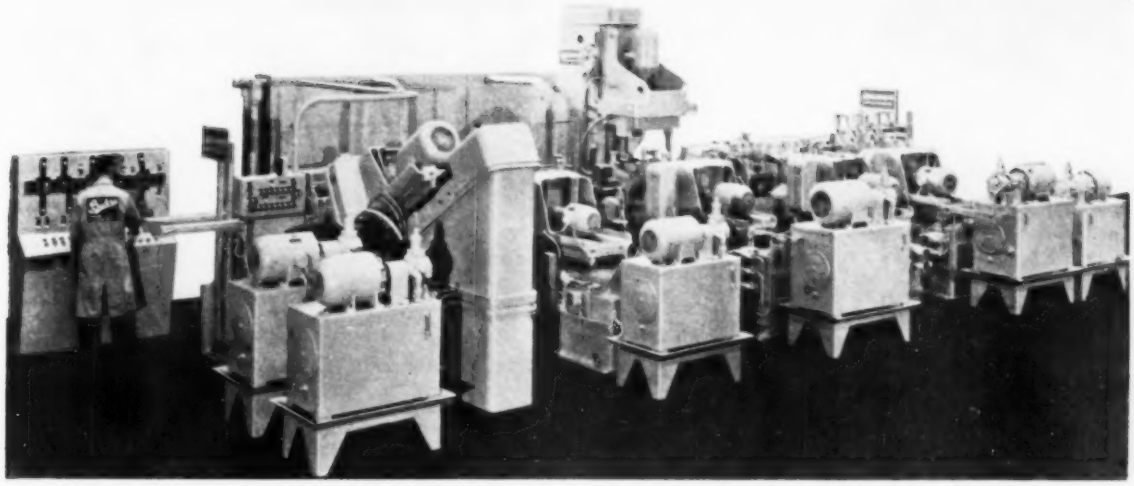
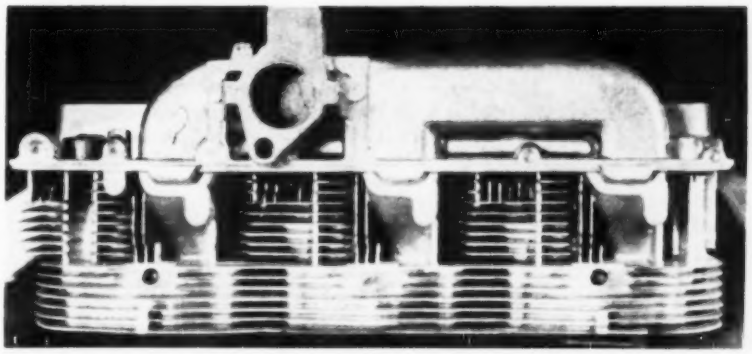


Conventional line makes Corvair's unconventional engine . . .

Die-cast aluminum cylinder heads for the Corvair are machined on a transfer line as conventional in design as the workpiece it processes is unique. New features in the line are the result of design progress rather than differences in workpiece design or material.

By building the line with all standard components, Buhr Machine Tool Co, Ann Arbor, Mich, cut lead time and eliminated the cost and operating difficulty of special design. The machine is somewhat more compact than one used for a cast-iron cylinder head, but not nearly in proportion to the smaller size and lower weight of the new engine. Because the six cylinders of the air-cooled aluminum Corvair engine are horizontally opposed, each engine requires two three-cylinder heads.

One of the features of the machine is that two methods of transfer from station to station are used: one for the first part of the line, another for the second part after the workpiece has been rotated 90°. Also, drill stations are provided as a safety measure for holes which are cored during the die-casting process.



Finned three-cylinder head is made of die-cast aluminum

Standard power units

Standard power units are used, although they have more power capacity than needed to machine aluminum, to provide higher machining feeds and speeds. However, all cutting tools are designed specifically for cutting aluminum. Drills have fast spirals and polished flutes and other cutters have polished flutes.

The line has 17 working and idle stations and is separated into two sections by the 90° turn-around. Operations consist of drilling, chamfering, boring, reaming and tapping. Cylinder heads are skidded along rails through stations 1 through 13 by a rotating transfer bar. They are moved through the last three stations by a walking beam. The index step is longer in the first section of the machine because the head is moved lengthwise.

After the operator loads a cylinder head manually at station 1 and presses the start button, the machine automatically processes the part on a 19-second cycle. Control of the two sections of the machine is integrated so parts pass from one to the other without interruption.

Drilling air justified

The fact that many holes are cored in die castings does not substantially reduce the number of machining operations. Drills are run through these holes to make sure they are clean. Drilling air is justified because complete inspection of the parts for correct hole size and shape would be required before finishing or tapping. Deep, small holes are cored about half way through the part and are drilled the rest of the distance.

Tests indicate that . . .

Metal is removed faster . . .

work-hardening is eliminated . . .

and tool life is increased . . .

. . .When high alloy steels are machined Hot

By R A Scott, tool engineer, North American Aviation, Inc, Los Angeles, Calif

The new high-strength, heat-resistant alloys in modern aircraft and missiles insure completion of missions—even though the vehicle may be virtually on fire. North American's X-15 manned space craft, for example, will glow red upon reentry into atmosphere and consequently employs a high-nickel-content alloy "armor" to withstand temperature as high as 1200 F.

But how do you machine such alloys as H-11, AM-355, and PH 15-7 Mo? Experience has shown these materials are extremely difficult to machine at room temperature. They work-harden rapidly under the plastic deformation that occurs in machining and, with tensile strengths close to those of the cutting tools used to machine them, they require extremely high cutting forces. As a result, cutting rates are very low and tool life is short.

It is known, however, that the strengths of such alloys decrease at elevated temperatures so that tool cutting forces can be reduced correspondingly. With this in mind, engineers at North American's Los Angeles division are investigating the machinability of these alloys at temperatures up to 1200 F to obtain increased stock-removal rates and better tool life.

Results so far from hot milling small test sections made of these materials indicate that stock can be removed at rates many times faster than is possible with conventional room-temperature machining. However, it appears that on larger sections where milling-cutter teeth are engaged for longer periods in hot materials, heat transfer tends to reduce tool life so that milling at ambient temperatures is more efficient. Further tests with different sizes and grades of carbide cutting tools are being carried out at North American to determine whether or not hot machining can be practical in such cases. Hot machining will probably be used extensively in rough machining operations and before heat treatment, where fast and economical metal removal is required.

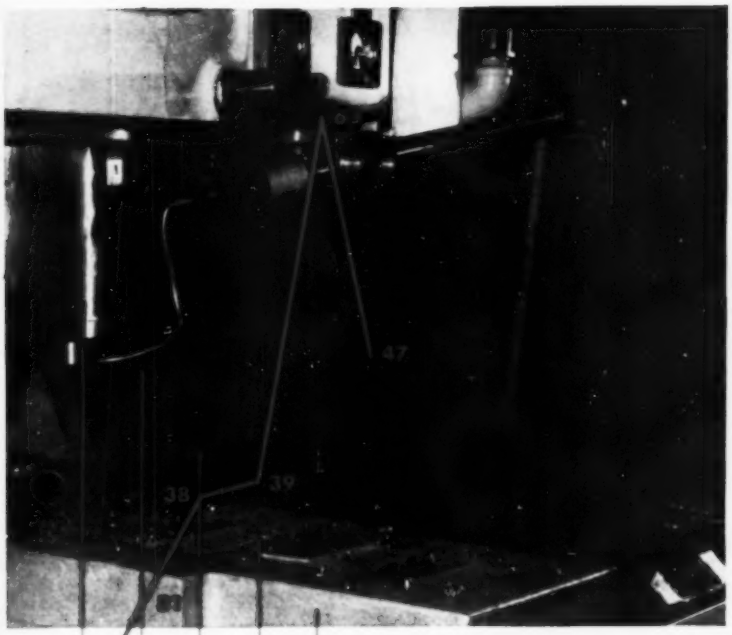
No particular problems are encountered in maintaining tolerances or surface finish. Hot-machined test parts are easily held to surface finishes of 125 mu in., and better finishes can be obtained with finer feeds, lighter cuts, and sharper tools than were used in the investigation In these setups, tolerances of ± 0.005 and 0.010 in. were held.

In hot machining to specific dimensions it is necessary to take into account dimensional changes resulting from thermal expansion. Naturally, this varies with the material being machined and the working temperature employed. For example, the mean linear coefficient of expansion of AM-355 at 800 F is 0.000,0071 in. per in. / ° F. Room temperature is subtracted from the working temperature to determine the amount of heat to be considered in calculating expansion. Thus a working temperature of 800 F less 68 = 732 F to be considered in calculating expansion. With a part to be finished to a length of 12.000 in., 732 times 12 times 0.000,0071 equals 0.0623 in. to be added. Consequently the part is machined to a length of 12.0623 in.

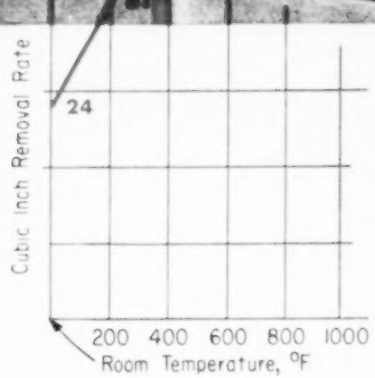
In hot machining the effect of high temperatures on the physical properties of the materials is an important consideration. To avoid changing the structures of these alloys, temperatures must be well below the drawing temperatures for heat-treated stock and below annealing temperatures for annealed material.

Temperature limits used in hot machining these alloys are based on remaining 100 F below annealing and ageing ranges. For example, the maximum temperature that can be applied to annealed AM-355 and PH 15-7 Mo without affecting the structure is 1850 F, while the maximum for H-11 alloy is 1525 F and for heat-treated stock, 875 F.

Another important factor taken into account is the effect of elevated temperatures on tool life. Although the cutting forces required are re-



AM-355 at 800 F . . .
Standard solid-carbide end mill slots and routs sample aircraft alloy at 850 fpm, 12-ipm feed, and depth of 0.06 to 0.20 in. Chip load is 0.0035 in. Finish is 125 mu-in. Airlox vise, with jaws sprayed with zirconium to protect them from heat, maintains constant pressure on the work at any temperature



800 F is optimum for AM-355 . . .
Cutter life falls off rapidly above 800 F. Removal rates indicate cu in. of material removed prior to dulling of cutter. Test was made with 8-tooth grade 690 carbide-insert face mill with 7° negative axial and radial cutting angles; 550 rpm, 0.100-in. depth of cut, feed of 15 ipr

duced by the decreased strength of a material at elevated temperatures, about 1/3 of the working heat is absorbed by the tool. Abrasive action of the material on the tool, being related to the shear strength of the material, is similarly reduced, so tool life is increased in proportion to the reduction in abrasiveness.

Tools and equipment

Various conventional machines may be used for hot machining as long as they have the power and rigidity needed for working high-strength alloys. Vibration and chatter are held to a minimum by rigid machines, minimum tool overhang, sturdy tool supports, and fixtures built to withstand high cutting forces; but reduced shear strength of the hot material somewhat reduces the need to control these conditions. At North American, a Model OM5 Sundstrand vertical milling machine of 50-hp capacity is used for hot machining. With interrupted cuts—so common in aircraft and missile parts—good results are obtained by means of a flywheel effect inherent in the Sundstrand machine. A special work fixture includes an Airlox S-200 vise and special heating jaws. Maximum heating temperature of the tool is 1400 F, obtained through a number of Watlow heating rods operated on a 230-V line and 2100 watts.

Grade C6 carbide cutters have been found to work best in hot machining. Cutters in diameters over 5 in. are inserted carbide, while smaller tools are solid carbide. Tests with both brazed and inserted cutters of smaller diameters resulted in failures because the carbide loosened at operating temperatures. HSS cutters have been found unsatisfactory at temperatures above 200 F.

Hot cutters . . .
Shell mill at top has 4-in. diameter, 14 teeth, 10° positive hook, and 15° helix. Slotting cutter in middle has 26 teeth, 6-in. diameter, 10° positive hook, and no helix. Four-flute end mill has 1½-in. dia, 10° positive hook, and 25° helix. Cutters here are all solid carbide

Heated stretch-press tools

Stainless-steel die sections, insulated from a base, are resistance heated to 1000 F, the preformed titanium alloy to 900 F. Wrap-formed at low tension, the part is produced to exact contour without thinning and there is no springback

By R H Ludwig, senior manufacturing research engineer,
Manufacturing Research Dept, Chance Vought Aircraft, Inc,
Dallas, Texas

Titanium alloys formed at room temperature contain residual stresses, which cause part warpage and springback. Part breakage is high because the percentage of elongation is non-uniform from sheet to sheet and may be insufficient. But forming at elevated temperatures increases elongation of the material and reduces chances of failure.

We therefore developed a stretch-press tool that will operate at temperatures to 1200 F. Basically, this tool consists of a stainless-steel die identical to the part it will form. Contour is maintained by securing the die to a Compreg base by means of stainless-steel supports. Low voltage, high-amperage current passes through the die to heat it.

Stainless steel, 0.090 in. thick, was shaped in a press brake to produce the die cross-section. The die contour was produced on a standard Compreg stretch die mounted on a Hufford stretch press. After contour forming, the stainless-steel die was normalized at 1400 F for 5 min to eliminate changes in length after the dies were in use.

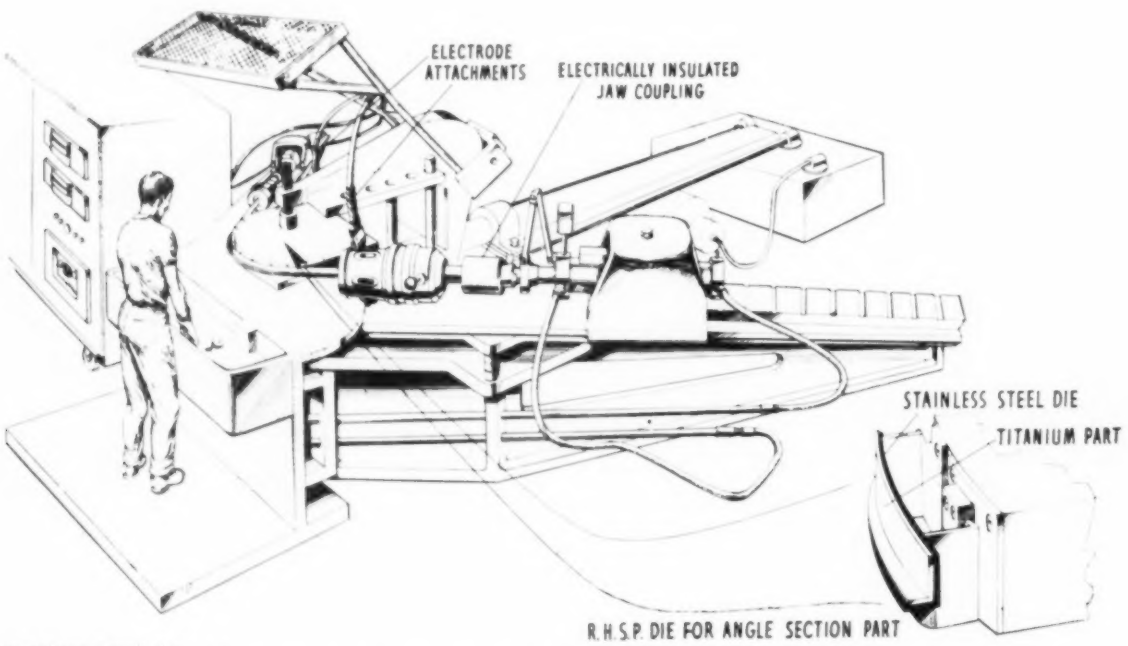
An aluminum conductor tab was secured to each end of the stainless-steel die by stainless-steel bolts. The tabs act as cooling fins to reduce heat transfer into electrical cables.

A millivoltmeter and thermocouple read the temperature. Accurate temperature readings depend on the method of connecting the thermocouple to the die. Here a 1/16-in. hole was drilled through the die and countersunk from the forming face side. A chromel-constantan thermocouple wire was twisted once and inserted through the hole with the end of the thermocouple wire in contact with the part. Eutectic- type filler rod was flowed into the countersunk hole to secure the thermocouple wire.

The tool base was constructed from Compreg, fabricated into a conventional stretch die for forming the stainless-steel die portion of the tool described. After the stainless-steel die was formed, the forming face of the Compreg stretch die was removed by cutting along the contour 1 in. back from the face.

The remaining smooth contour face provides the surface for attaching the stainless-steel die.

Again 0.090-in.-thick stainless steel was used for the die supports because of temperature and strength



Stainless-steel die . . .
0.090 in. thick is backed up by supports. Only the center of the die is fixed. The two ends are guided, but float for expansion

form titanium alloy sections

required. Twelve 2 x 3½-in. pieces were cut, and a ½ in. 90° flange formed on one end of each piece. This flange formed the base for the support. The top of each support was then notched to receive the die. Portions of the notch were cut back to reduce heat escape by conduction from the die into the support.

The supports were welded to the die on 4-in. centers.

Aluminum reflector plates, approximately 3½ x 4½ in., were secured to the contour face of the base on 4-in. centers. The plates provide a bearing for the die supports and also reflect heat from the Compreg base.

Guide Lugs

Because the stainless-steel die would expand and contract with temperature changes, the supported die was allowed to float. This was done by bolting the center die support to the base and allowing either side of the die to float, but guided to proper contour and held down by lugs.

Insulating Couplings

The stainless-steel die must be electrically insulated from the Hufford stretch press. This was accomplished by two insulating couplings. One coupling was mounted between each machine jaw and the machine itself.

Heating Principle

The stainless-steel die is made the heating element, to eliminate the cost of separate heating elements or cartridges.

The amount of heat generated depends on the resistance, current, and time that current flows. Resistance is determined by the dimensions of the stainless-steel die.

$$W = I^2Rt \qquad (1)$$

Where:

W = watts/second
I = amperes
R = ohms
t = seconds

Because resistance is controlled by the physical size of the stainless-steel die, the most desirable die length should be established and the smallest die cross-section area possible should be used.

$$R = \rho \frac{l}{A} \qquad (2)$$

where:

ρ = Resistivity of the material
l = Length of die, cm
A = Cross-section area of die, sq cm.

In Formula 1, time is shown as a factor controlling the power required. The time should be held as low as possible, to reduce the power lost in radiation and also to maintain high production rate. A maximum of 4 minutes is recommended.

Voltage output of the Hufford resistance heating machine is 20 volts, and the die resistance can be calculated from Formula 2. Current is found by Ohm's Law (allowing 10% on current for heat loss).

Operating Procedure

Four factors are involved when forming at elevated temperatures on the stretch press.

1. Part Temperature—a constant at 900 F. This temperature was used because it gives the smallest decrease in yield strength with the greatest increase in per cent of elongation for 4908 titanium, yet does not exceed the critical temperature causing a phase change.

2. Die Temperature—a constant at 1000 F. There is approximately 100 F differential between part and die during forming.

3. Wrapping Speed—a constant at Number 3 on the Hufford machine wrap-speed control. Nothing could be gained by wrapping the part at a slower rate.

4. Tension Applied to Part—the only variable and predictable from psi-vs-part area curves. Because pressure reading is below 500 psi and *critical*, a 0-1000 psi gage was used in place of the high-pressure gage normaly mounted on the press.

Operating procedure for each die was basically the same. The 4908 titanium was sheared to size and pre-formed to the necessary cross-section. The part was chucked in the Hufford machine jaws and the Hufford resistance heating machine set to heat and maintain the die at 1000 F. The part was wrapped to contour, then part tension was released to prevent excessive part elongation. Then part temperature was increased to 1000 F for 3 min to set the part. The part was cooled to 800 F before removal.

Angle section parts were formed without shims or guides. Actually, the use of shims and guides caused the part flanges to run hotter than the web. Actually, the web should run hotter or at least the same temperature as the flange because the greatest elongation takes place in the web.

Regardless of the part cross-section formed, the average time to form one part was as follows:

	Min.	Sec.
Load part	2	0
Heat die	1	0
Form part	0	35
Set part	3	0
Remove part	1	0
Prepare for new part	3	0
	10	35

Predicted construction time for resistance-heated production tools was derived from research-tool construction as shown below:

Part Cross-section	Large Fixtures 40 to 60 in. long	Small Fixtures Less than 40 in. Long
Hat	80 hr	60 hr
Angle	60 hr	40 hr
"Z"	60 hr	40 hr

Result

There was no noticeable scaling of the stainless-steel dies at temperatures to 1200 F. At the proper temperature, part tension, and wrap speed, parts were produced with satisfactory cross-section and contour. Thinout was approximately 0.002 in. for 0.025 in. thick 4908 titanium.

At present, any titanium alloy formed at temperatures below 1150 F must be stress relieved (1000 F for 1 hr). Because 4908 titanium cannot be formed at temperatures beyond 1050 F, the stress relieving process is required. After stress relief is completed, final forming is required and can be done very simply by the addition of an accessory which converts the resistance-heated stretch die into a resistance-heated final form fixture.

Should the U S

PRO: *"The entire free world seems to be out of step except us. While we are still debating whether to trade with Russia, our closest allies are concerned with* how *to trade with Russia."*

"Top management of top U S corporations IS interested in East-West trade but is even afraid to be seen at a meeting like this."

That statement, made by the meeting's co-chairman, characterized the outspoken, no-holds-barred atmosphere of a controversial "Briefing Session" of the conservative American Management Association earlier this month in New York.

The subject: East-West trade.

Attending were executive representatives of major U S corporations in a wide variety of industries—electronics, metalworking, oil and chemicals to name a few. And because a majority of attending companies were frankly interested in trade with Russia and her satellites, the two-day session twisted the question, "Can we afford to trade with Russia" into "Can we afford *not* to trade with Russia?"

Government noncommital

There were plenty of arguments on both sides, with government representatives taking a middle-of-the-road stand, described by one attending executive as a "sort of 'Let's test the water with our toe first'."

Industry representatives were by no means so conservative in their views. Said Manufacturing Chemists' Association's Cleveland Lane, "More than 10,000 years of our best technological development have gone into producing just a few of the items on Russia's want list. Without Western aid, I don't think Russia can reach its Seven-Year-Plan goals."

Russia, he said, wants to buy prototypes of U S machines that it can copy at will. Not only that, the USSR wants to get the know-how from us that goes into their output.

Lane, who assumed the role of spokesman for the dead-against-trade-with-Russia faction, said "It is tragic to assume we should trade strategic war materials for such items as vodka and furs."

The Manufacturing Chemists' Association, of which he is assistant to the president, is against East-West trade because it feels technical aid to Russia would aid the war effort to which Russia would resort if economic methods of gaining superiority fail.

Copyright violations cited

Russia, he added, is not a party to international copyright agreements —steals technical ideas right and left without regard to their originators. Outstanding examples of this, Lane said, are to be found in Russian tractors and autos, and even U S rug designs have been copied by the Russians.

Diametrically opposed to the views of the Manufacturing Chemists' Association were the opinions of Stefan Jean Rundt, head of the international business consulting organization bearing his name.

Asked on the second day of the briefing to outline what had gone before, Rundt said he would prefer to sum up what had *not* been said:

"It seems," he said, "that those who have had the least dealings with Russia are most against East-West trade . . . The very idea that we can ignore 650,000,000 people is an anomaly. The entire free world seems to be out of step except us. While we are still debating whether to trade with Russia, our closest allies are concerned with *how* to trade with Russia."

Whether we in the United States like it or not, Rundt said, the U S embargo on Russian trade has broken down and our position is "rather absurd" because this country is still embargoing some items the Reds export themselves.

Insincerity and hypocrisy?

America's attitude toward East-West trade, Rundt said, "reflects a deep-down insincerity and hypocrisy on the part of our body economic, social and political. There's something rotten to the core here." (It was Rundt who made the statement that most top firms are interested in doing business with Russia but are afraid to admit it).

"We ourselves," he concluded, "have lowered the paper curtain upon the facts of life. I don't trust Mr Khrushchev, but I find nothing wrong with U S firms negotiating for the sale of machinery for peaceful uses. We might just as well do what the entire world is doing—we are strong enough."

While the opinions expressed by Lane and Rundt represented the extremes of American attitudes toward East-West trade, other session speakers dealt with the pure mechanics of such trade.

For example Professor Harold J Berman, research associate in Harvard's Russian Center, said that the U S businessman doing business with Russia must remember he is trading with a sovereign nation, not just another firm, and that a nation claims immunity from law suits. The Russians do, however, observe the

trade with Russia?

CON: *"It is tragic to assume we should trade strategic war materials for such items as vodka and furs . . . What would we gain by selling U S know-how? Loss of world markets and military security."*

letter of a contract—"What isn't in writing doesn't exist"—and are very correct in their commercial dealings with other nations.

Ground rules for East-West trade

In order to trade successfully with Russia, Berman said U S businessmen must observe several rules:

- Be patient—Russian negotiations are always long-drawn-out affairs, taking at least weeks.
- Meet the Russians personally if possible—"If they know you and your product is good, they'll do business for years."
- Go to the people directly responsible for a deal, avoid such trading setups as AMTORG, and "go as high as possible."
- If a deal is really big, try to get to Mikoyan himself.
- Study Russian habits and customs and adjust to them.
- Abandon "negativistic policies" toward trading with the Russians. Adopt a bold position. Forget your own political views. In this way you take the initiative away from the Russians.
- Always check any move beforehand with the U S Government.

Adoption of a trade agreement with Russia, Berman said, has several advantages to the U S. For one thing, the United States could thus assure getting the Russian products it needs, and the U S could sell products the Russians are now getting from other nations.

Such an agreement in Berman's opinion would also assure more efficient protection of trade in strategic goods, and would at the same time prevent the Russians from dumping trade goods on world markets at below-U S prices. "In this country," he concluded, "the businessman must be the conscience of government, not vice versa as it is in England."

England's attitudes and experiences in trading with Russia were given during the session by J B Scott, sales director of Crompton Parkinson Ltd, London electrical machinery manufacturer. He is also chairman of the Russian section of the London Chamber of Commerce, and former business advisor to the British Board of Trade. Himself an outstanding proponent of East-West trade, Scott admitted that the British public attitude toward such trade is about equally divided.

Head of the so-called "Scott Mission," which paved the way for the Anglo-Russian trade agreement, Scott said that the Russians are difficult to deal with only in that they are shrewd bargainers and know exactly what they want and when. "And they pay cash on the line."

British trade with Russia has grown tremendously in the last few years, Scott said, and will pick up even faster over the next few years. U S trade with Russia could be "enormous" by comparison with Anglo-Russian trade—"at least three times as much, if the United States really wants Russian goods."

Scott spoke of Britain's East-West trading "consortia," groups of manufacturers of similar products who deal with the Rusisans as a unit. There are many such groups doing business with the Russians today, and the Russians prefer to deal with them rather than with individual firms. Reason for this is that the Russians frequently offer goods in exchange, which a consortium can easily resell.

There is no reason why the United States could not form such consortia ("If the Justice Dept says it's not in violation of anti-trust laws," Berman interjected), according to Scott, who hinted that one has already been formed by 28 U S firms to sell $26 million worth of industrial equipment, nature unspecified, to Russia.

British manufacturers, Scott emphasized, are very careful not to sell technical know-how to Russia. This is also true of the Eastern Bloc nations with which the British deal under separate agreement.

V Alkhimov, chief Russian commercial attaché in the U S, who sat quietly through two days of brickbats and bouquets for East-West trade, had this to say, "There's no use you Americans worrying about Russia getting your know-how. We know the processes—what we need is the equipment. If you don't want to sell it, it is up to you."

Foreign arrangements list available

The editors of AMERICAN MACHINIST have compiled a list of the foreign agreements made by U S machine tool builders and cutting tool manufacturers. This is not a list of foreign sales agents, but a listing of arrangements made for manufacture of U S designs abroad and for manufacture or sale of foreign designs here. A copy will be sent free to any subscriber, by Reader Service Dept, AMERICAN MACHINIST, 330 W 42nd St, New York.

U S takes active part in developing . . .

International fastener standards

U S participation in development of international standards through the ISO, the International Organization for Standardization, is on the increase. Though the U S takes part actively in only about one-half of the ISO's technical committees, it does hold the secretariat of many committees working in the newer fields such as nuclear energy, plastics, and electronics, and has shown increasing interest in other committees.

Last year the U S sent a ten-man delegation to the committee on standardization of screw threads. Most recent proof is the active part taken by the U S delegation to the fourth meeting (in Milan, Italy, Oct 20-23) of ISO/TC 2, the committee responsible for developing dimensional standards and physical property specifications for bolts, nuts, screws, studs, other threaded fasteners, cotter pins and washers.

This was the first time that this country took part in the work of TC 2. The three-man delegation was headed up by Richard B Belford, technical advisor of the Industrial Fasteners Institute, Cleveland.

No standards or recommendations which would affect U S manufacturers now or in the future were adopted at Milan. Specific accomplishments included:

- Determination of widths across flats and head heights for two series of hex-head bolts and one series of hex nuts, all in metric measure. Also recognition of a parallel series in inch measure, based on existing American Standards.
- Establishment of a research project to investigate and recommend limits for radii under bolt heads.
- Acceptance as an international standard of Types A and B threads as used on thread-forming tapping screws. Metric standards will be a straight conversion from the inch standard (B18.6.4-1958).
- Development of dimensional standard in metric measure for hex slotted and castle nuts.
- Authorization for development of a standard for hex-head socket screws in metric measure which would parallel the new American 1960 series.
- Initiation of project to prepare international specification covering strength of fasteners.
- Continuation of work on a document to illustrate and describe, in four languages, all the various types of standard fasteners, their characteristics and elements.
- Development of a series of standard lengths for bolts in metric measure. (The philosophies of the metric countries vary from those of inch countries in this area, consequently, no parallel standard in inch measure is contemplated.)
- Review of a proposed standard for cotter pins, which with slight revision appears acceptable to all countries.

Metric vs Inch

The U S delegation to TC 2 did not budge on the inch. It now appears that the real question is not whether the U S will adopt the metric system (considered impossible by many in this country), but which system the smaller, growing countries will adopt for themselves. The U S, Great Britain, and Canada are the major "inch" countries, with Australia, South Africa, and other British Commonwealth nations following their lead. These countries have accomplished a large measure of standardization on fastener size and specification among themselves since World War II.

The most important "metric" countries include France, Italy, Germany, and Russia, plus many smaller European countries. These nations, all using the metric system, have not yet standardized on fastener size and specifications.

Finally, there are a number of "in-between" countries such as Sweden, Norway, Holland, and Belgium, plus a number of countries just now coming of age industrially, which operate on a dual basis. These countries don't care which system prevails—but they do wish it could be reduced to one or the other.

Without active U S support, ISO recommendations would favor the metric viewpoint—hardly in the best interests of the U S. Our participation, therefore, has aimed at dual inch-and-metric standards. Mr Belford sums it up this way, "I believe that in ten or fifteen years we can have two parallel standards—one in inches and one in centimeters. They will be complementary to each other. To get to that point, the metric countries are going to have to do a lot of standardizing among themselves. When we do get to that point, however, we can then match the two standards against each other, eliminate the duplications or unnecessary sizes, and arrive at a single set of standards for the whole world. But that will take a long time. I don't expect to see it in my lifetime."

Industrial Fasteners Institute sets up monthly index of fastener shipments

A new monthly business barometer makes its appearance this month as the Industrial Fasteners Institute, Cleveland, announces the publication of a monthly index of industrial fastener shipments.

John Whitsett, IFI's chief statistician, says that the index is based on shipment figures supplied by representative fastener firms, both members and non-members of the Institute. The new index is intended to serve as a short-range business barometer, in much the same way that the NMTBA's statistical data serve as a long-range barometer.

Data will be published on the last working day of the month for the preceding month, and will be presented as an unadjusted index based upon dollar sales during 1947 through 1949 as 100, and also as a seasonally adjusted index figure with the same base period.

Because fasteners are seldom produced as an end product, but as a basic component of assembled parts, the shipment index should serve as a prediction of upcoming business in assembled metal products. Fastener shipment figures follow very closely the Federal Reserve Index of Industrial Production and the Federal Reserve Index for Metal Fabricating.

The seasonally adjusted figures for fastener shipments during the first three quarters of 1959, compared with the same periods in the two preceding years, are as follows:

	1957	1958	1959
Jan	173	133	140
Feb	177	117	153
Mar	166	103	152
Apr	157	102	175
May	168	111	175
Jun	162	120	187
Jul	184	133	165
Aug	155	120	111
Sep	159	141	119

base: 1947-1949 = 100

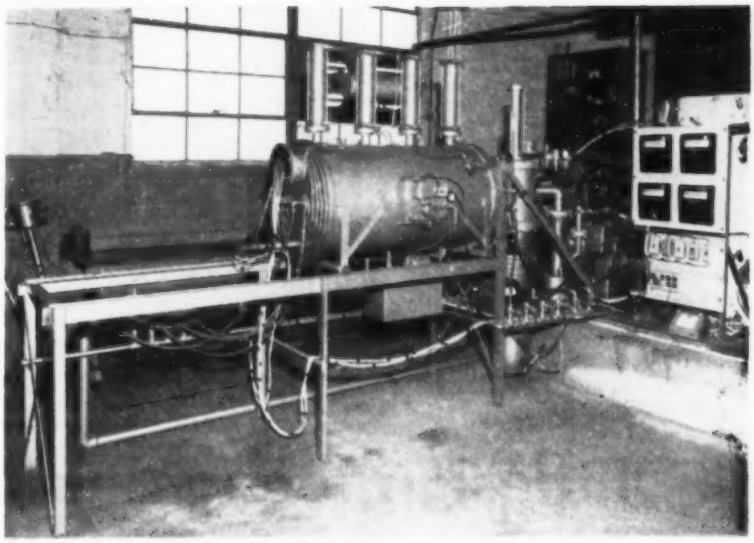
Vacuum brazing for "Eagles"

The first production-scale application of the principle of vacuum brazing will be the fabrication of honeycomb structures for the Eagle air-to-air missile at Grumman Aircraft Engineering Corp, Bethpage, NY. The company holds a major subcontract from Bendix Aviation Corp for the missile's airframe, propulsion system, and ground-handling equipment. The vacuum-brazing furnace ordered recently will be able to handle panels over 50 sq ft in area.

Major advantages claimed for vacuum brazing are that it eliminates the welded "envelope" or retort commonly required for honeycomb brazing and that it provides a purer atmosphere than can be obtained with an inert gas.

In conventional techniques, the panel is sealed into a metal container which can be purged and filled with an inert gas. Thus, atmospheric contamination is avoided by displacing the air with the inert gas.

In contrast, the Stokes-Bukata process (invented by Stephen Bukata, consulting engineer for the F J Stokes Corp, Philadelphia) eliminates contamination by removing the air—by drawing a high vacuum in the immediate vicinity of the workpiece.



Prototype vacuum-brazing furnace . . . can handle 1 x 2-ft honeycomb panels without welded envelopes or inert gases. Larger equipment on order will braze 50-sq-ft panels

Cover sheet goes over entire heating tray . . . and forms top of reusable envelope. After the chamber is closed, the envelope is pumped down, and brazing is performed in a vacuum instead of an inert-gas atmosphere

Operating procedure

In operation, the cylindrical chamber is first moved horizontally to the end of its twin rails to expose the lower heating tray for loading. On the tray is the reference base, a block of graphite that supports the honeycomb panel. The base may be flat or contoured as required.

After the panel is positioned on the base, a cover sheet is placed on top of it. This cover sheet rests on an O-ring gasket running around the perimeter of the water-cooled frame, and it forms a vacuum-tight seal with the gasket.

A similar sheet and gasket are located beneath the graphite reference base. Together, they form an envelope that completely encloses the honeycomb structure.

When the cover sheet is in place, the chamber is closed against the fixed end plate and evacuation can begin. As the pump pulls the air out of the envelope, atmospheric pressure seats the cover sheets more and more tightly against the O-rings.

Then, during the brazing operation, the effectiveness of the seal is further increased when hydraulic cylinders on top of the chamber force the upper heating frame down onto the cover sheet. At the same time, the top cover sheet also presses down on the honeycomb panel making sure the face sheets are securely positioned against the core.

Heat for brazing is provided both above and below the honeycomb by rows of heating elements that operate on ordinary line voltage. Temperatures of 1750 F will handle present honeycomb work, and the equipment can be operated successfully at 2100 F.

NEW NMTBA PRESIDENT
Alan C Mattison
President
Mattison Machine Works
Rockford, Ill

FIRST VICE PRESIDENT
Everett M Hicks
Vice president & general manager
Grinding Machine Division
Norton Co
Worcester, Mass

SECOND VICE PRESIDENT
Francis J Trecker
President
Kearney & Trecker Corp
Milwaukee

Outdesign foreign machine tools to

There is only one prescription for survival of the machine tool industry, and that is to outdesign its competition. Various restrictions, tariffs, low foreign wage levels and other barriers make competition tough, but the builder who makes the best machine will get the business. This is just as true now as in the past.

Ralph J Kraut, president of the Giddings & Lewis Machine Tool Co, made this statement in his Presidential Address to members of the National Machine Tool Builders' Association at its 58th Annual Meeting at the Greenbrier, White Sulphur Springs, W Va, November 19-21.

He pointed to the Machine Tool Exposition in Chicago in September 1960 as the time for the industry "to assert its international superiority" and to prove that American-built machines are better in design, in performance, and in capacity to reduce costs than those built anywhere else in the world.

The machine tool industry's current critical situation was the theme of most of Mr Kraut's remarks. He summarized much of the contents of a letter that he sent recently to the Office of Civil and Defense Mobilization on behalf of the industry, bringing out a number of important points. For example:

Average rate for production workers in the U S machine tool industry (exclusive of fringe benefits) is about $2.40 an hour, compared with $1 in France, 85¢ in England, 60¢ in Germany, and 35¢ in Italy. The differential between labor rates is so great that a machine costing $10,000 to build here can be made in West Germany for $6250. (This on the assumption that materials and components costs are the same in both countries—actually they are lower in Europe.)

Recent bids on machines for U S government agencies, Mr Kraut revealed, were $216,565 as the lowest U S price, compared with $112,995 as the lowest foreign bid. On a lathe, the lowest U S bid was $13,246 against a foreign bid of $8570. For four plain grinders, $130,206 was the lowest U S bid, compared with $82,206 by a foreign company.

Imports up, exports down

Machine tool imports today account for 6% of total sales within the United States (based on the first four months' figures for 1959), Mr Kraut declared. This compares with 4.7% in 1958, and 1.4% in 1951. These percentages are computed on the tariff value of imports. When translated into domestic sales prices, the figure for the January-April period of this year would be 17.5%, instead of 6%.

For some years, machine tool exports have progressively declined, Mr Kraut said. Between 1952 and 1958, engine lathe exports dropped 52.6%; turret lathes 59.9%; automatic chucking machines 41.2%, knee and column type milling machines 73.3%, cylindrical grinders 49.9%. Aside from the big differential in wage rates, a major contributive factor to this decline has been the impediments, other than tariffs, imposed by many foreign nations.

Some of the impediments are: advance deposits required for imports, exchange licenses, exchange taxes, blocked non-resident accounts, export licenses, forced exchange of payments received in foreign currency, import licenses, import quotas, state trading. The complications are incredible.

Increased competition from imports and the shrinking export market have compelled the U S machine tool industry to move abroad, Mr Kraut reported. About 47% of builders surveyed by NMTBA either have commitments abroad or are planning to move productive capacity abroad (Editor's note: a recent survey by American Machinist —see p93 if you want a copy—shows some 60 companies in the machine tool and cutting tool industries with some kind of foreign manufacturing arrangement). U S builders with foreign operations have in this country more than 75% of domestic capacity.

Mr Kraut asked, on the basis of these facts: What effect will the trend to move abroad have on our defense production capacity? Is the United States to become a secondary producer of machine tools? Is the bulk of world machine tool capacity to be located abroad, chiefly in Europe, where it could easily be taken over by Russia?

Meanwhile, Mr Kraut continued,

TREASURER (re-elected)
Graham E Marx
Vice president & general manager
G A Gray Co
Cincinnati

NEW DIRECTOR
Hayward A Gay
Vice president
Cincinnati Milling Machine Co

NEW DIRECTOR
John F Herkenhoff
President
Minster Machine Co
Minster, Ohio

hold world markets, US builders told

most of the machine tools in U S metalworking plants are obsolete and are costly to operate. Research and product development have gone so far recently that any machine tool five years old probably is obsolete. Many users are unaware of this fact. One reason is that machine tool users are bound in their thinking by obsolete U S depreciation practices.

Unrealistic depreciation

Every other country, including Canada, encourages the write-off of machine tools in one-half the time that we do. The problem of obsolescence in machine tools is not confined to civilian production. It applies to the Defense Department, in which an elaborate and sound replacement program exists for the most part only on paper.

Rumors are afoot of an all-out Soviet economic offensive whereby Russia may attempt to undersell all the rest of the world, Mr Kraut said. Only last April, the State Department issued the statement that USSR in 1958 turned out four machine tools to our one. In addition, the European Committee, representing nine Western European nations, says that there are 1600 machine tool builders in Western Europe.

The growing Russian machine tool threat was discussed at a meeting of the European Committee and NMTBA Directors in Paris on September 18. Another meeting of the two groups will be held in Chicago in 1960 at the time of the Machine Tool Exposition.

A reciprocal machine tool mission with the USSR proposed early this year by the State Department, has been temporarily abandoned because Russia refused admittance to more than half of the 21 Russian plants that delegates wished to visit.

Mr Kraut agreed with predictions that U S industry will need to invest heavily in modern efficient machinery during the 1960's and expressed the hope that "the machine tools required for this boom will be manufactured in the United States rather than abroad."

Most of the NMTBA Meeting program centered on problems of manufacturing abroad. Featured was a panel discussion with Walter K Bailey, president, Warner & Swasey Co, as moderator. Panel members: T Laurence Strimple, president, National Acme Co; L W Scott Alter, president, American Tool Works Co; Bruce F Olson, president, Sundstrand Corp; and James K Fulks, executive VP, Ex-Cell-O Corp.

129 members of NMTBA and 29 non-members (chiefly publications, oil companies, etc) have taken space at the Machine Tool Exposition—1960, Donald H McIver, vice president, Ex-Cell-O Corp and chairman of the Exposition Committee, reported. Members have been assigned 308,582 sq ft of exhibit space, or 15% more than in 1955.

ELECTED SECRETARY
Grayson M Stickell
President & general manager
Landis Machine Co
Waynesboro, Penna

Russia's space plan

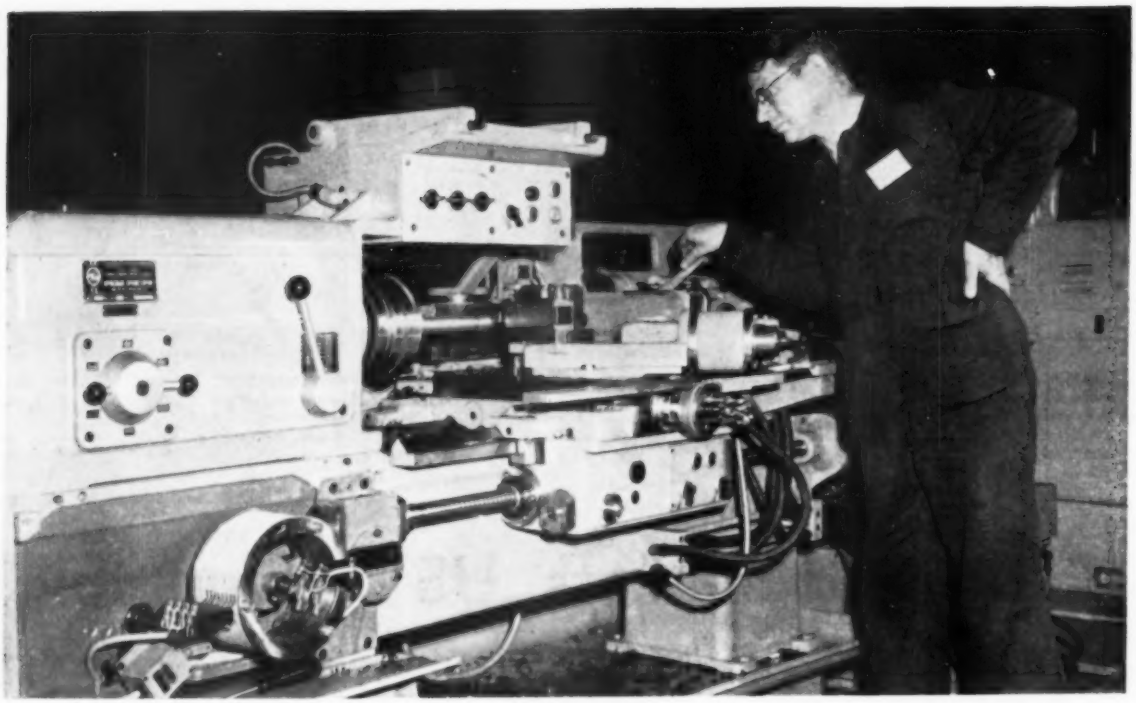
The Russians have just made public some startling plans:

A Soviet satellite bearing two men will orbit the earth for 14 days by the end of the year.

Four weeks later, two men with a television camera will orbit the moon twice.

In March or April of next year, two men and two women will make a six-month trip around the moon.

Also on the Russians' program is a plan to send rockets to Mars and Venus sometime in 1961, and other rockets will be fired to Mercury and Jupiter a short time later. Soon thereafter, manned ships will go to Mars and Venus.



Russia exhibits automated lathe

By J O Ellison, president, Harron, Rickard & McCone Co of Northern California, San Francisco, Calif

How do Soviet machine tools compare with those made in the U S? An expert sizes up a Russian shaft-turning lathe recently demonstrated in this country. Here is a detailed description

Shown at the recent Soviet Trade Fair in New York City, the Model 1C62 shaft-turning lathe is an automated, tracer-controlled machine of a size and type not produced in this country. Loading and unloading are automatic, and so is machining.

U S machine-tool builders make medium-duty, general-purpose lathes of the same size; we also build production shaft-turning lathes with automatic work-handling equipment. But we do not combine the two as the Russians do on this machine.

The most lasting impression I have of the demonstration, aside from the technical points, is that the Russians were very good showmen. The machine looked good, it sounded good, and it ran good. Operators were expert, and the display—with shafts being loaded, machined, and unloaded automatically—was very impressive.

According to the interpreter at the Fair, the machine comes from the Red Proletariat (*Krasniy Proletariy*) machine-tool plant in Moscow. It is a variation of a family of lathes, all built to a great degree around common elements. I think the basic lathe in this family (which was not displayed, but on which the design is obviously based) is the Model 1K62 lathe, generally built as an engine, toolroom, or conventional shaft lathe. I have heard that the plant produces about 1000 lathes a month.

Basic dimensions

Here are some of the machine's basic dimensions: Maximum swing over bedways was 15¾ in.; maximum swing over cross slide, 8½ in. Bed length was 8 ft.

As an engine lathe, maximum distance between centers was 40 in. (On the machine at the New York Show, this distance was slightly less than 24 in., because an unloading device took up part of the bed area.)

The automatic loading device could handle work as large as 2⅜-in. diameter and 14½ in. long. A 10-hp motor drove the headstock, providing 12 spindle speeds ranging from 200 to 2000 rpm.

Because this show machine was a basic engine lathe adapted for production, it did not have the usual quick-change feed arrangement, nor did it have a feed rod. Feeds were in inches per minute and not geared to the spindle for feed in thousandths per revolution. Apparently ranging from 0 to about 20 ipm, feeds were infinitely variable, with rapid traverse of about 100 ipm.

Unusual bed design

The bed, an inverted V-way design, was somewhat unusual, as the sketch shows. It had two V's—one for carriage alignment, the other for tailstock alignment. One unique feature deserves mention here: The spindle was run in the *reverse direction*, causing the tracer-slide and cross-slide assemblies to be in tension rather than compression, and

transmitting the cutting forces to the under side of the bedway instead of the conventional top-side V-way.

The tracer slide was mounted conventionally on a bridge-type carriage, at a 30° angle on a cross slide. Front mounted, the tracer head was arranged for use with flat templets only. Similarly, templets—three of them—were mounted on the front side of the bed. This arrangement permitted roughing, semi-finishing, and finishing cuts in sequence.

Programming unit

Programming for the machine cycle was from a large copper drum mounted on the headstock, where the quick-change box normally is (see photo). About 10 in. in diameter, the drum was about 6 in. wide, with a 6-in.-dia center hole. This drum was geared to and rotated by the carriage feedscrew. Mounted in the drum's center hole were collector shoes that put 110-v, 60-c current into the drum. Contacting the drum's OD were about eight fingers or switches (each controlling a separate function) arranged to bear against the drum.

A wide paper tape or strip masking the copper drum, was the basis of control: Holes about ¼ in. in diameter, pierced in the tape, programmed the machine cycle. Function of the holes was to permit the contactors to pick up current from the drum.

Automatic work handling

The automatic loading and unloading equipment worked very well. Basically, operation was by several hydraulic cylinders. This equipment was very fast, yet worked quite smoothly.

Shafts to be machined were fed from a conveyor line into an inclined loading chute mounted just above the work area. This loading chute held about 12 shafts of the size being machined in the demonstration. During the work-handling cycle, the finished shaft fell into a V-shaped, trough-type unloading arm, which carried it to a discharge chute at the tailstock. A similar arm placed a new shaft between centers for machining. Control for the loader and unloader was a motor-driven unit that drove a cam unit; with each cam revolution, several copper contact fingers were closed in sequence for the various functions.

Hydraulic controls

One hydraulic unit—floor mounted, away from the lathe—powered the following: carriage feed and rapid traverse, tracer-slide movement, tailstock operation, and the work-handling device. Housed in a tank, this unit included pumps, control elements, and a vertically mounted motor with a frame size roughly the same as our 7½-hp, 4-pole, 3-phase motor (unusually large for a unit of this type). The feed-rate selector—a very unique arrangement—was incorporated in the main hydraulic power unit, but I was unable to learn much about it.

The hydraulic tank and package unit was exceptionally small for this type of service. Offhand, I would say it was about half the size of this type made in this country. Furthermore, the entire tank was made of cast-iron section, bolted together; normally, we use steel weldments.

Automatic feeds

During the cut, the feed rate was automatically changed, rate of change being affected by the automatic control drum. I noticed that the first cut was maximum depth, as customary in machining a stepped shaft. For this cut (a fairly short length) feed appeared to be about 0.010 in. When this diameter was finished, the tool was stepped out to pick up the next diameter and feed rate increased to about 0.020 in.

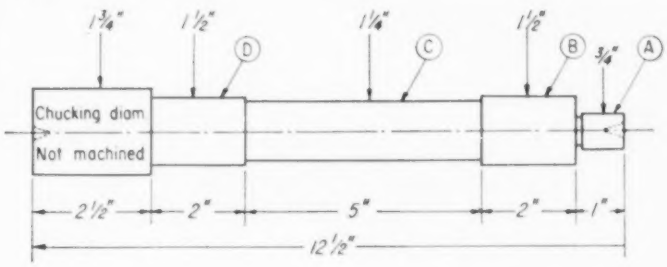
An interesting innovation was the skip cycle during the finishing pass. On the roughing pass the shaft was relieved for about 8 in. between the two larger diameters (see sketch). Because a single pass was enough for this relieved area, the machine would skip, on the finish cut, that area in rapid traverse automatically; the shift from feed to rapid traverse and back to feed was very smooth.

Tailstock and Headstock

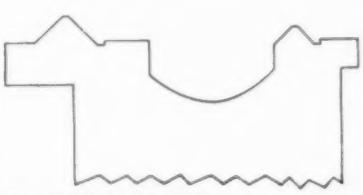
The tailstock was somewhat unique and, frankly, it looked very good. At first glance it looked conventional, about what you might see on a 16-in. engine lathe. But it included these features: The tailstock spindle was hydraulically operated, also said to be hydraulically locked during the cutting cycle. A small hydraulic cylinder must have been built in to work the conventional two-shoe locking unit.

According to the interpreter, the clamp had to release before the tailstock spindle could be retracted; inversely, when the spindle was advanced, it would reach working position before the clamp was applied. The tailstock did not have the flange-mounted large cylinder at the rear

Approximate Dimensions of the Shaft Machined at the Show



Material: 1010 mild steel
Turning Speed: 650 rpm
Work: 1¾-in.-dia barstock milled to length and centered
Roughing Feeds: 0.010 in. on diameter (A)
0.020 in. on diameter (B)
0.030 in. on diameter (C)
0.020 in. on diameter (D)
Approximately 0.080 in. on diameter was left for the finish cut.)
Finish Pass: About 0.020-in. feed on diameters (A), (B), and (D)
Rapid-traverse skip of diameter (C) was at about 75 ipm



Sketch of lathe bed...
shows carriage and tailstock construction

that most of our air-operated tailstocks have.

Headstock drive was through multiple V-belts. There was no clutch, and the motor was a plugging-type (for fast stops), although a conventional clutch is standard on the basic Model 1K62 lathe. Maximum cutting load appeared to be less than 5 hp.

A carbide tool did the cutting. It was a brazed-tip tool with a very deep chip-curl grind. The toolpost had a flat seat, without inserts—hardened or otherwise—for the tool to rest against. Because the spindle was run in the reverse direction, the actual cutting forces were taken through the two clamping screws.

According to the designer, running the spindle in reverse gave better chip control and chip disposal. In designing for this type of cutting, he resorted to a rather unique bed-and-carriage bearing design. But he probably didn't have too much choice here, because the cutting forces would have to be absorbed by the underneath side of the bed.

Automatic Machining Cycle of Soviet Lathe

1. Transfer rough shaft from loading chute to working position between centers.
2. Advance and clamp tailstock spindle.
3. Start spindle rotation.
4. Advance tracer slide to contact roughing templet with stylus.
5. Start carriage at feed rate approximately .010-in. feed and machine diameter (A).
6. Increase feed rate to approximately .020 in. and machine diameter (B).
7. Increase feed rate to approximately .030 in. and machine diameter (C).
8. Decrease feed rate to approximately .020 in. and machine diameter (D).
9. Withdraw stylus and tracer slide.
10. Reverse carriage motion in rapid traverse approximately 75 ipm.
11. Index stylus vertically to position for finishing templet.
12. Stop carriage in the starting position for finish cut.
13. Advance tracer slide to contact finishing templet with stylus.
14. Start carriage feed at approximately .020-in. feed. Machine diameters (A), (B).
15. Engage rapid traverse and skip relieved diameter (C).
16. Engage carriage feed at approximately .020-in. feed. Machine diameter (D).
17. Withdraw tracer stylus and tracer slide.
18. Reverse carriage motion in rapid traverse approximately 75 ipm to starting position.
19. Index stylus to position for roughing templet.
20. Stop spindle rotation.
21. Unclamp and withdraw tailstock spindle.
22. Transfer finished shaft to the discharge chute.

Pros and Cons

There were, in my opinion, five outstanding features built into the Soviet machine:

1. The automatic stylus shift from roughing to semi-finishing to finishing templets.

2. The fast, effective, and automatic feed-rate change.

3. The versatility of the hydraulic power units, which control feeds and rapid traverse completely independently of spindle speed.

4. The fast and impressive automatic loading devices.

5. The tailstock's neat appearance and incorporation of hydraulics.

But the machine also had several disadvantages:

1. Poorest feature seemed to be the automatic control units for programming work. The design concept is not new in any sense, and the unit undoubtedly requires considerable maintenance. And to prevent long down-time for repairs, a spare-parts inventory for every machine is probably needed. It also did not appear to have setup flexibility or a proper means of compensating for tool wear and tool changes. Finally, the control unit did not look particularly cheap to manufacture; compared to similar controls on our machine tools, it looked antiquated to me.

2. The manual controls, which were largely electrical (for cycling the machine manually or for setups) were located in front of the loading chute—very convenient, but also very vulnerable to damage from chips, coolant, or dropped workpieces. These controls were definitely misplaced.

3. Although represented as a fully automated unit, capable of conveyor-line operation without constant operator attention, the machine is not practical for this work, in my opinion. The most obvious reason is that the hydraulic tracer slide and tracer head (as used) would require a bleeding cycle every time the machine was shut down for 15 minutes or more. If there were an interruption in the line, this machine probably would be subject to a jam-up or tool breakage if it were automatically started without operator attention to the tracer assembly.

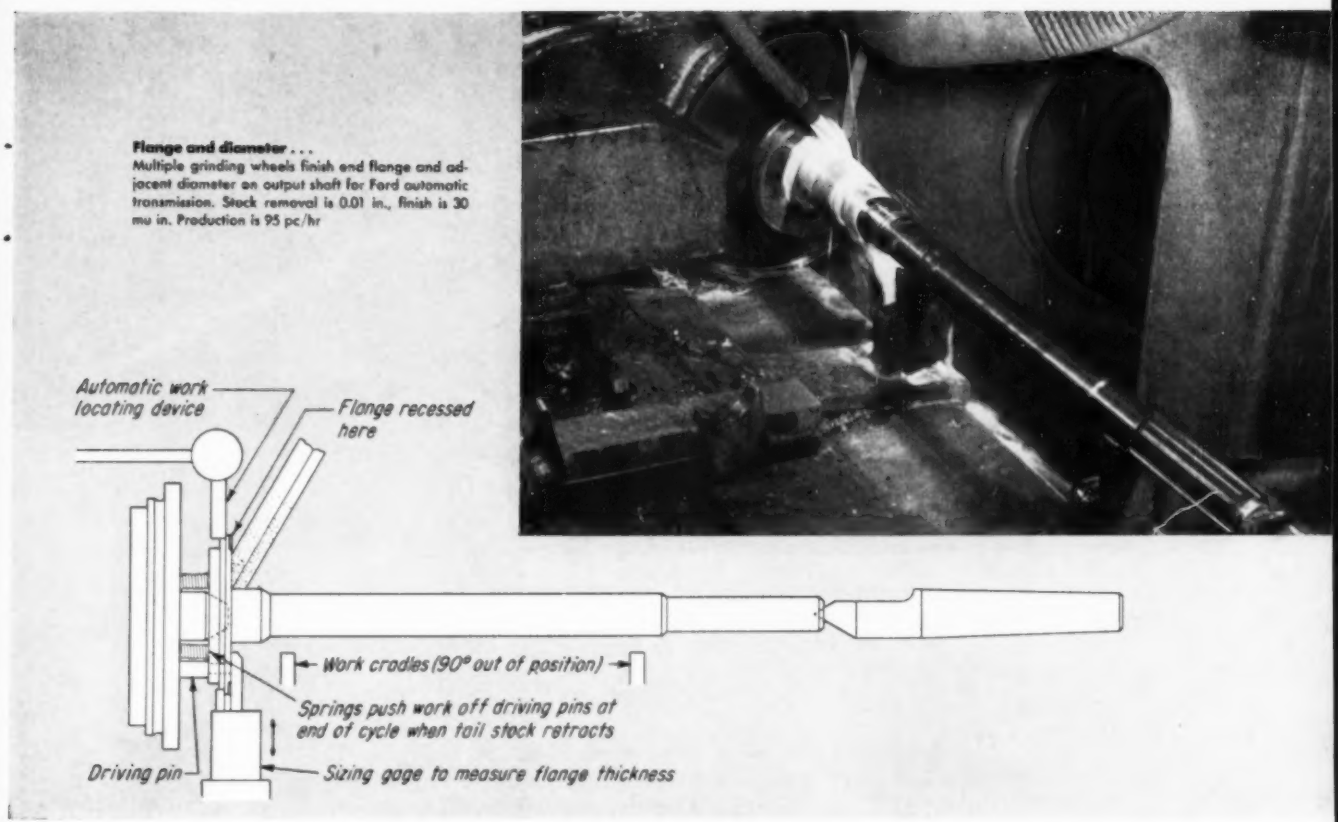
4. The work-loading and handling device placed very definite limitations on the range of work that the machine could handle. And because a fairly long setup would be involved in the change from one workpiece to another, the machine apparently would be practical only for long runs.

How good?

The Russians' choice of components from their volume-produced, general-purpose lathe lines in the makeup of this automated machine was spectacular as a demonstration. However, it looked to me like a compromise in their actual preference. Basically, they started with very light machine elements, thereby limiting this machine to shaft turning in the 5-hp range (continuous-duty cutting of ferrous metals). Although shaft work under 2-in. diameter can be handled by a 5-hp machine, the margin on the unit for intermittent overload and for continuing dependability under continuous rugged duty, did not appear to be present, as it is in current American designs.

If this machine were built in America, it would not in my opinion be very saleable against similar American machines (the Monarch Monomatic, the Sundstrand, the Fay Automatic, and others). If it were produced here, the machine would cost at least 75% or 80% as much as the above machines. But although it would be at least 50% lighter, it would be less than 50% as powerful.

I am without first-hand knowledge of the foreign machine-tool market, and there cannot make a very valid comparison of this machine's sales potential, compared to that of our own, in foreign markets. But I would surmise that it might be offered in world markets by the Russians, complete as I saw it in New York, for around $10,000. If this estimate is correct, we would probably have an extremely difficult time competing at this price, particularly in low-cost labor areas, where certain buyers might like to have an "automated" machine even if it needs a semi-skilled operator.


Automatic work locating device
Flange recessed here
Work cradles (90° out of position)
Springs push work off driving pins at end of cycle when tail stock retracts
Driving pin
Sizing gage to measure flange thickness

Flange and diameter . . .
Multiple grinding wheels finish end flange and adjacent diameter on output shaft for Ford automatic transmission. Stock removal is 0.01 in., finish is 30 mu in. Production is 95 pc/hr

Precision with multi-wheel grinders

By F Kenwood Jones, Grinding Machine Div, Norton Co, Worcester, Mass

One obvious way to reduce manufacturing costs is to combine operations at a single setup. But until recently this technique was difficult to apply to precision grinding. Table-mounted truing devices require high operator skill, extensive tooling, and time. It is difficult to dress all wheels true with the work and each other, and to hold tolerances for finishing. **But the development of the automatic wheelhead truing mechanism has made the job much easier, faster, and more reliable.**

Ford Motor Co applies the idea, for example, at several grinders in its Sharonville, Ohio, automatic-transmission plant. Eight Norton semiautomatic multi-wheel grinders and four Norton C-V 4 angular wheel slide grinders finish multiple surfaces on the output and sun-gear shafts for the company's two-speed automatic transmission.

In all, 13 diameters and a flange surface are ground (see illustrations). Compared to single-wheel operations, grinding time is reduced 70%. The machines are loaded and unloaded only four times instead of 14, so there are savings in handling time as well.

Multi-wheel factors

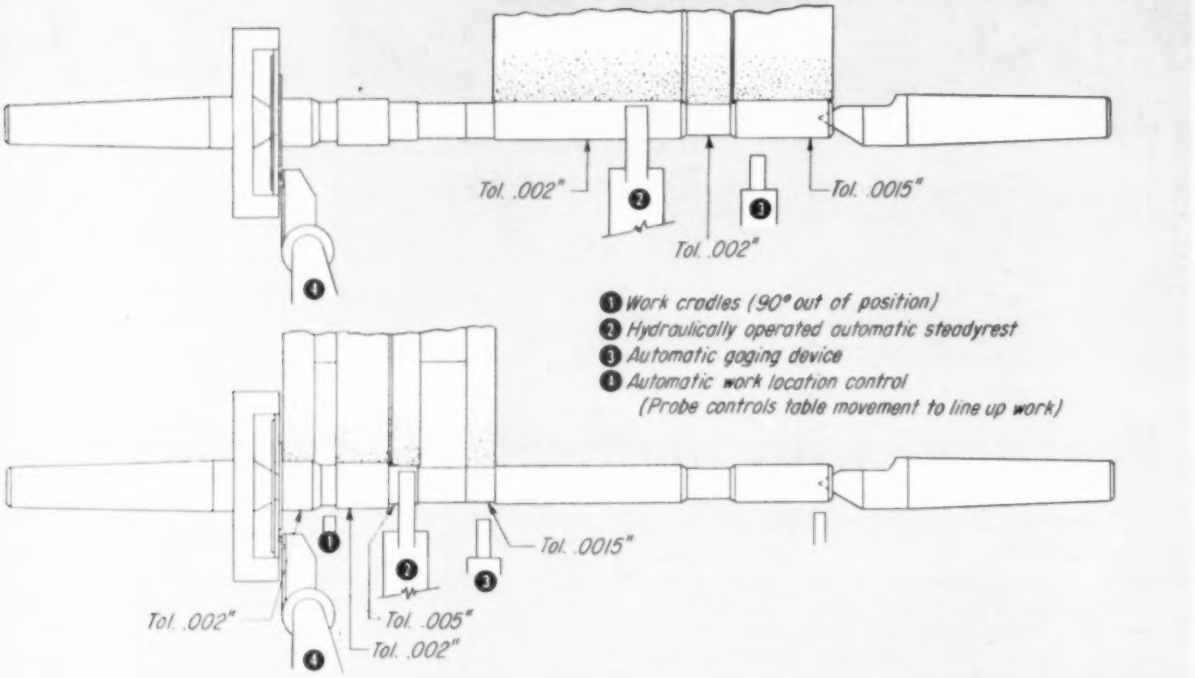
Although multi-wheel grinding is normally applied to high-production parts, where savings are easier to calculate and justify, the technique can be worked out in a small shop, too. If there is more work than one man can handle with one machine, and if the parts being processed have multiple diameters, a multi-wheel grinder may well be practical. Multiple-diameter and form grinding is most common today in three areas: plunge grinding on conventional cylindrical grinders, plunge grinding on special multiple-wheel grinder, and plunge grinding on angular wheel-slide grinders.

A multi-wheel grinder permits exact duplication of form at each truing cycle, automatically, without interference with the work. Form bars allow special shapes on the wheels without loss of accuracy. And this kind of wheel truing does not take time away from the grinding cycle, unlike older methods.

Along with the evident advantages are some factors that might, if allowed, become problems. One is the large amount of grinding swarf produced by multiple wheels—often more than a conventional coolant system with settling tanks can handle. One solution is built-in mechanical sludge removers or filters—magnetic or paper. A central coolant system can be applied where there are several grinders in the same area, and the grinders can be equipped for this or any other kind of special sludge handling.

Rapid gaging is necessary because

Seven diameters . . .
Output shaft is green-ground on seven diameters in two steps. Tolerances range from 0.0005 to 0.001 in. Production here is 68 pc. hr on the first operations, 72 hr on the second



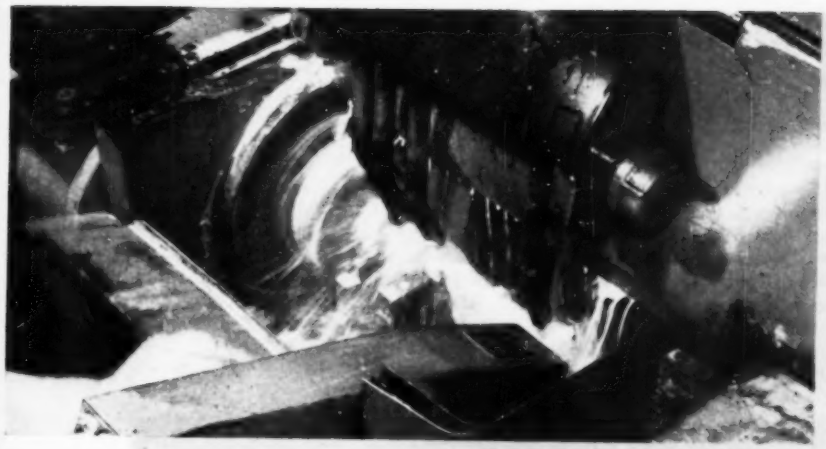
the work is handled quickly. In-process or post-process gaging can be applied with varying amounts of instrumentation to feed back a signal or to shut down the equipment if the parts start falling out of tolerance. If the machine is operating properly, however, it is usually sufficient to check the dimension with the tightest tolerance, assuming other dimensions with wider tolerances will fall inside limits. Warning devices to alert an operator that size is approaching tolerance limit are installed when one man operates several machines.

Steadyrests are required even more than on standard single-wheel grinders. Usually the rest is mounted to balance a number of forces from the grinding wheels. More than one steadyrest may be required, and these may be hydraulically powered to reduce operator work and time loss. However, steadyrest design is usually a function of the machine builder when the equipment is intended for a specific operation.

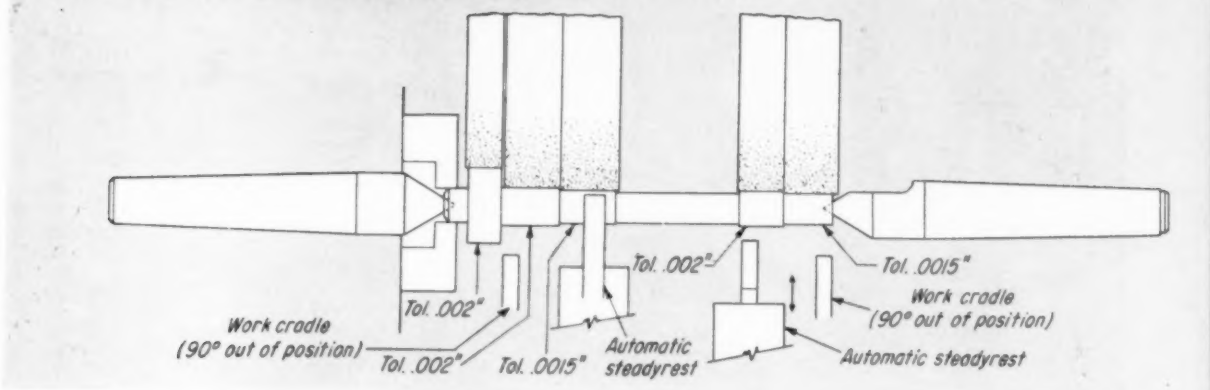
Pick wheels

Wheel selection has one extra function when multiple surfaces are being ground. If there are great differences in work diameters, there will be corresponding differences in wheel peripheral cutting speed. Wheel grades can often be selected to compensate for this effect. If not, a two-step operation may be required to get all the larger diameters at one operation, the smaller ones at another.

Wheel spacing—and the decision to use one wide wheel or several thinner ones—is a factor decided by wheel economics, unless wheel grades must vary. Truing opposite a diameter that need not be ground should be avoided. Wheel spacers can be loaded on the machine spindle—in sizes from ¼ in. up.



Five diameters . . .
Sun-gear shaft for automatic transmission is ground to produce five diameters at once. Production is 87/hr



Depending on the work, multiple wheels can be mounted on a multi-wheel machine or on a conventional grinder. A standard 6-in. machine will handle wheels up to a width of 5 or 6 in. Wide-wheel mounting sleeves and a wide wheel guard are required. But if the work is long, with grind diameters spaced along its full length, a heavy-duty multi-wheel grinder is a better choice. The heavier spindle provides rigid support at any point along the spindle.

Equipment for multiple-wheel truing has been available up to the development of automatic wheelhead truing devices, but it has many drawbacks. Table mounts often mean setting up the dresser again each time the wheels are changed. Operator skill is crucial, and the whole truing job is slow and cumbersome. Sometimes the capacity of the grinding machine is limited by the truing device. And manual truing always cuts into work-cycle time.

Automatic wheelhead truing bypasses most of these problems, improves quality, and increases productive working time.

England's apprentices are a mixed lot

It's pretty difficult to find an average, or even a typical, British metalworking apprentice, an on-the-spot survey of apprentices attending an Industrial Welfare Society meeting at Oxford shows.

But an "inquiring reporter" survey of 400 apprentices did come up with this norm: he is between 17½ and 22 years old, doesn't follow his father's trade, has money in the bank, spends between 90¢ and $1.80 a week on clothes, probably went to a secondary school (high school), lives at home, owns a car, and is thinking of emigrating from England.

Fathers' jobs vary greatly, from managers to laborers, from ministers to race track bookies—but only 20% are the sons of skilled metalworking craftsmen.

Nearly 90% of England's apprentices live at home, and one-third of those living at home give between $5.60 and $8.40 a week to their families for lodgings, while about 25% give between $2.80 and $5.60 to their parents, and another 25% between $8.60 and $11.20 a week.

Nearly 40% of the questioned apprentices spend between $2.80 and $5.60 a week on entertainment and personal purchases, 15% spend less than $2.80, and about 10% spend from $8.60 to $11.20.

Almost 5% are married, slightly more than 17% are engaged, and about 30% are "going steady."

Thirty percent expect to be promoted one day to supervisory jobs, only 10% expect to be executives.

Half the apprentices expect to stay with their present employer when they become journeymen, and about 15% expect to stay "for a while."

But apprentices haven't changed with the times in one way—their spelling is atrocious, many of the inevitable "don't know" replies came out "don't no."

Flame cutting replaces

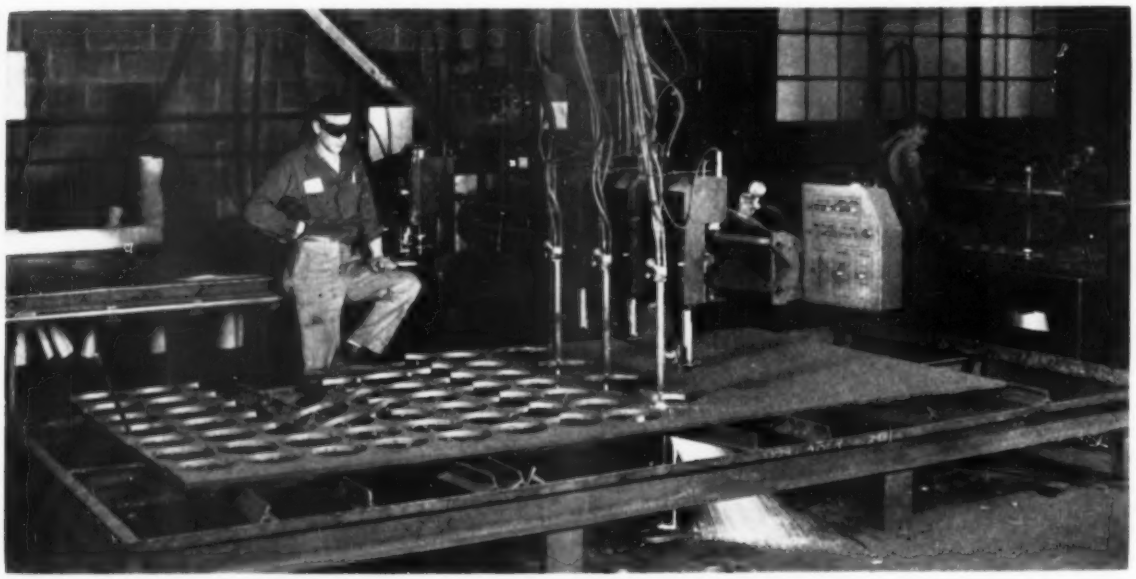
By L V Erkenbrack, welding engineer, American Hoist and Derrick Co, St Paul, Minn

Many straight-line cutting operations that formerly went to the shears are now being assigned to the cutting torches at American Hoist and Derrick Co. Also going to the flame cutter are parts with intricate profiles that used to require machining.

The reason is simple: The flame-cutting machine can handle these jobs more efficiently. Torch motion is now controlled by an electronic line tracer instead of by the aluminum-strip templets previously used to perform this function.

In fabricating cranes, hoists, derricks, and other heavy industrial equipment, we flame-cut hundreds of different shapes out of mild steel in thicknesses from ¼ to 6 in. Naturally, we purchased the line tracer to improve our cutting operations, but the actual results achieved in day-to-day operation of the machine have exceeded our expectations in both accuracy and cost.

For example, the increased accuracy of tracer-controlled cutting has eliminated follow-up machining of a number of small parts. Too, the cost



Electronic line tracer guides torch . . .
to cut flanges from 1¼-in. plate. These parts are typical, but others include small brake-band ends and large crawler side-frame plates

Tracing unit "reads" drawing . . .
At start of cut, operator positions tracer over curled entry line and switches to automatic operation. The machine does the rest

These templets will be scrapped . . .
as they are replaced by line drawings that can be traced by optical scanning system. Storage space will be released

of labor for preparing a pattern for the line tracer is only about 20% of what it would be for a strip templet of the same part.

The metal-strip templets consisted of 1 x 1/16-in. aluminum stripping nailed around the edge of ⅜-in.-thick plywood cut to the specified shape. This assembly was secured to a metal base sheet.

With these templets, the choice between a templet-guided operation and a manual operation depended upon the number of parts to be made, the accuracy required, and the availability of templets. As the cost of templets was high, they were normally specified only for repetitive parts or orders involving a large number of pieces.

Now we are specifying flame cutting even for rectangular parts with no holes or contours. Flame cutting has replaced shearing on all plate over ½ in. thick.

Cutting procedure

The step-by-step procedure now established for the tracer-controlled cutting machine is:

1. Obtain cutting pattern: If the pattern has already been drawn up for a previous production order, it is simply taken out of file "books" in the Templet Department.

If the part is a new one, the engineering blueprint is sent to the Templet Department where the drawing is made on heavy paper stock with ordinary drafting instruments. Although pencil lines are sufficient, we have found that ball-point pens are easy to use and provide a satisfactory line thickness.

2. Start cutting sequence: The operator places steel plate of the proper thickness on the cutting table and secures the drawing to the tracing table. Then he positions the head over the curled entering line, starts the torches, and switches the control to automatic operation. The drawings have curled entering lines for both the ID's and the OD's.

3. Cut shapes automatically: The optical scanning system follows the center of any line 0.040 in. wide or less at speeds up to 25 ipm. Error is less than 0.005 in. on either side, according to the manufacturer, National Cylinder Gas, Division of Chemetron Corp.

The line tracer will continue on its proper path without being disturbed by an intersecting line, provided the smaller angle between the two lines is greater than 45°. Minimum turning radius is 3/32 in.

4. Stack shapes for delivery: The operator can stack the completed pieces in tote boxes and perform other duties while the torch is operating on automatic cycle. Therefore, one man is assigned to handle all the work on the machine, except of course for preparing the patterns themselves. He is also responsible for planning the shape-cutting work so that there will be minimum waste of plate and minimum time consumed in setting up.

Greater flexibility

Because of the greater flexibility of the line tracer, we have been able to increase the number of parts that can be shape-cut. Previously, a number of complex shapes, both large and small, were too difficult to reproduce in strip templets.

One example is a 36-tooth ratchet, 1⅜ in. thick with a 3-ft OD, that had to be cut out entirely by machining. Although the machining itself was expensive, the cost of accurately reproducing the 36 teeth with metal strips on the edge of a plywood base was far greater.

The line-pattern system also proves its flexibility when changes must be made because of design improvements in the products. Metal-strip templets would have been laboriously reworked or scrapped entirely and replaced. Now, however, we simply erase the pattern drawing where necessary and draw in the changes.

Accuracy cuts costs

We also attained substantial savings by cutting down on the amount of shearing and machining for various plate shapes. Washers, spacers, and other parts, for example, often had to be cut oversize.

It took a follow-up machining operation to bring them to final dimensional tolerances, usually in the range of ±1/32 in. Now, our cutting accuracy is essentially the same as that of the pattern drawing, so there has been no need for further machining of flame-cut pieces.

Rectangular parts and those that had at least several straight edges were once fabricated as much as possible by shearing. Then, if the pieces had shaped contours or holes, they had to be shape-cut as well in a subsequent operation.

For example, ⅜-in. boom portal plates were once sheared individually, marked, and shape-cut manually. Our present procedure is to stack eight plates and flame-cut them simultaneously from a line-pattern drawing.

These and other benefits have been achieved with tracer-controlled flame cutting by exploring every possibility of applying its full capacity.

Flame cutting replaced machining . . .
on this 36-tooth ratchet. Metal-strip templets were too difficult to make, but line drawing for electronic tracer is a simple layout with ordinary drafting instruments

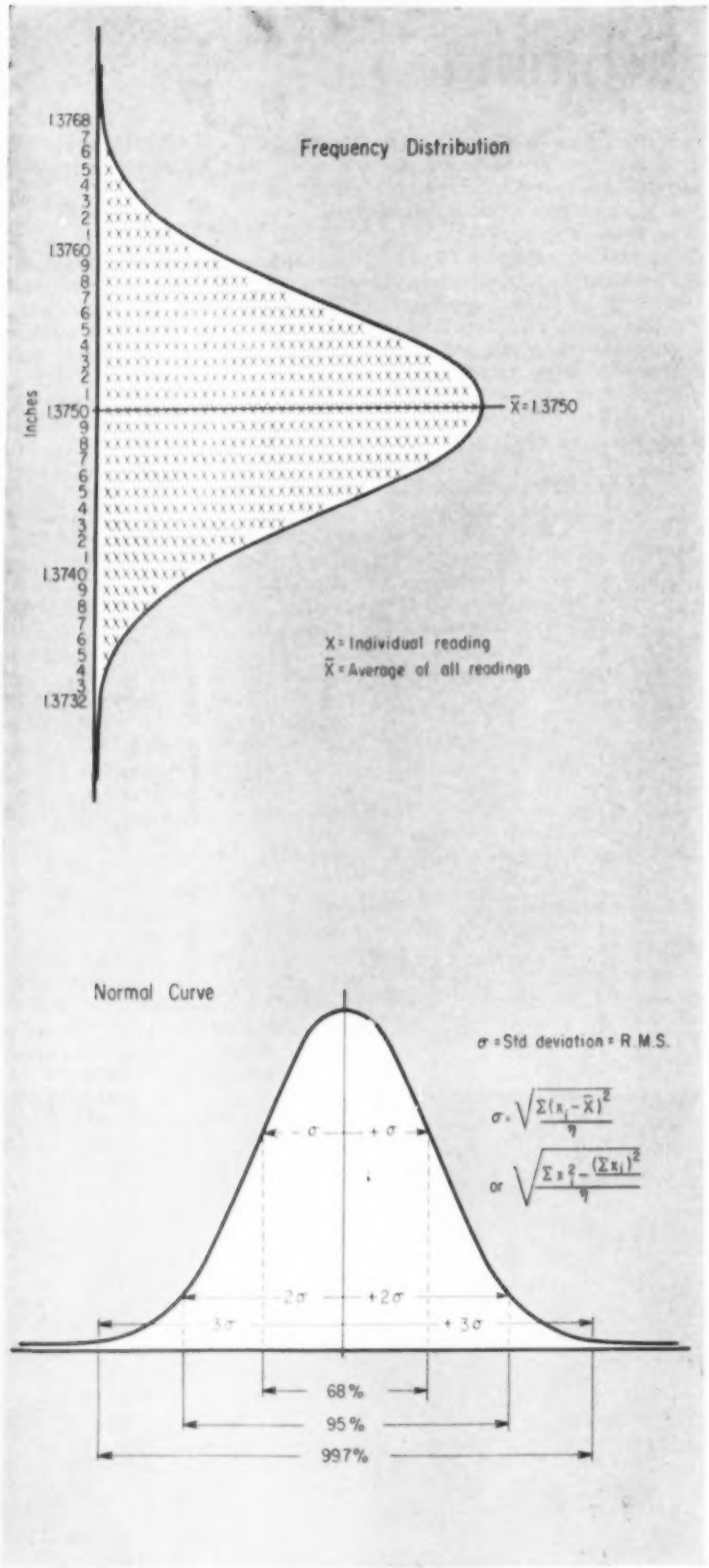


Fig. 1 (top) . . . Frequency distribution of histogram
Fig. 2 (bottom) . . . Normal curve with sigma limits

What's missing

"This machine can hold to ±0.0005 in." You've probably heard such descriptions of machine accuracy dozens of times. But does such a bilaterial specification tell you all you want, or need, to know? It can't, because it is incomplete and, often, inadequate.

What's missing is a term that tells you how often the machine can be expected to produce to that tolerance; that is, how many times out of 100 or 1000 runs the part will come out to specification.

Tolerances, scrap, rework, inspectors, gage manufacturing businesses —all exist because of inherent variations caused by men, machines, tools, and variable material characteristics. And these variations determine the chances or odds that a product will fall within the specification limits.

Machine capability

Quality control and production engineers often make statistical machine-capability studies, especially in high-scrap-producing areas or where assignment of particularly close-tolerance work is being contemplated.

Such studies are still quite rare, so a word about why they are made and what they achieve would seem to be in order.

First, these engineers recognize that there is variation among parts produced by a machine (in fact, no two parts will be found identical if you have the means to measure fine enough), and they are interested in learning to what extent natural variations are likely to occur. Second, they gather some data directly from production runs and, after some fairly simple calculations, come up with a brief, complete description of the accuracy or capability of the machine.

Variations have patterns, and if we can describe any pattern of variation, we can derive useful data and relationships. To derive such relationships we must measure the desired characteristic to a fineness which will not only detect differences but will also give us a reasonably accurate picture of the dispersion in the data collected.

Assuming that we can measure some result and gather data, we may construct a picture of the variation, similar to that in Fig. 1. Here the unit of measurement is inches, the scale is in 0.0001-in. increments about

in machine-tool tolerances?

By Edward E Kirkham, chief development engineer
and Herbert A France, manager of quality control
Pratt & Whitney Co, Inc,
West Hartford, Conn

the nominal value, and the tally marks are X's.

Normal distribution

Fig. 1 represents a variation pattern found to exist in almost everything—dimensionally among the parts produced by a machine, the repeatability of a comparator, the height or shoe size of adult males, the number of days to process orders through a shipping department, etc. This is called *normal frequency distribution*, and a smooth curve drawn through the peaks of the columns of X's is called the *normal curve*. (Any variation pattern so charted is a frequency distribution, or histogram, though it may not be normal in shape.)

The measure or description of the dispersion of individual values about their average, $\overline{X}$ (X-bar), is the *standard deviation* or root-mean-square (rms) of the deviations of all values from their average. Identified, symbolically, by the lower-case Greek letter sigma, σ, the standard deviation may be computed from either formula in Fig. 2. Once determined, it will be in the original units of measurement and be plus or minus, because it applies to either direction from the average, $\overline{X}$.

A normal frequency distribution, or curve, has these properties:

- It is symmetrically shaped.
- Plus and minus σ, 3σ, and 6σ contain 68, 95, and 99.7%, respectively, of all the measurements or observations.

These percentages can also be considered as odds in a probability statement:

- 68 out of 100, or about 7 out of 10, values will fall between plus and minus σ.
- 95 out of 100 values will fall between plus and minus 3σ.
- 997 out of 1000 values will fall between plus and minus 6σ, or only 3 out of 1000 will exceed the same limits.

These probabilities do not apply to a non-normal distribution. Sigma still exists and still means standard deviation, but different sets of probabilities go with different patterns of variation.

Now you can see where the bilateral specification is lacking—it must be equated to some number of sigmas to be defined completely, the number of sigmas being dictated by the degree of reliability you need.

The obvious question now is, "How many parts do I have to measure to get an accurate measure of dispersion?" If you had to measure every part, the expense would be prohibitive. But thanks to some mathematical relationships between samples and their parent population (as we think of a machine's total work output potential), it is possible to predict with sufficient accuracy the total inherent variability (distribution spread) which may be expected in the long run by checking sample pieces from the lot.

Sampling techniques reduce the checking problem to economical proportions, but sampling must be done carefully. All samples must be pure, unbiased random samples; that is, they must be selected at random from among all possible choices. Such selection is aided by the random number tables that may be found in any statistics or quality-control text.

Statistical tolerances

Once a statistically significant amount of data has been collected and the necessary calculations made, machine capability can be defined not as a bilateral ($\pm$) or range function alone, such as 0.0006 in., but as a continuous function of a probability distribution such as

$$\sigma = \pm 0.0001 \text{ in.}$$

wherein the normal distribution is implied, which in turn tells us that 68% of all diameters, lengths, or whatever it is we are concerned with, will deviate from the nominal size by as much as, or less than, ± 0.0001 in.

The most common description is

$$6\sigma = 0.0006 \text{ in.}$$

wherein the $\pm$ sign is omitted to indicate that almost all (99.72%) of the variability will not exceed a range of 0.0006 in. and parts will be within ± 0.0003 in. of nominal size.

Until recently, only manufacturers' existing production machines have been described or evaluated in this manner. Pratt & Whitney and several other companies have been trying to statistically express their accuracy requirements in purchase orders for new equipment, but where such things as different operators, tools, and materials were certain to produce a variety of sigmas, the buyers have had to assume some of the responsibilities for the accuracies they sought.

Responsibility shifts

Now, with numerical control and the improved environmental conditions needed to achieve greater accuracy, more of this responsibility is placed upon the machine tool builder, since many of his previously uncontrollable variables are now within his control.

It is now possible to evaluate a greater number of operating characteristics, with a high degree of assurance that the performance will be the same in another location, specifically, the customer's plant. But let's get down to specifics. Consider the statistical treatment of positioning accuracy of numerically controlled jig borers and rotary tables, an operating characteristic that possesses a stable degree of variability under controlled environment and which has a significant (major, but not total) effect upon the accuracy of parts produced thereon.

When we speak of positioning accuracy, we infer the inherent accuracy in positioning to any point from any other point, which involves both the repeatability of positioning at any point and the absolute accuracy of the built-in linear, or circular, "yardstick."

At first glance, the task of determining the positioning accuracy of the machine slides appears to be impossible, because a 60 x 48-in. jig borer table, for example, can assume 600,000 positions (0.0001-in. increments) in its longitudinal travel and 480,000 in its transverse. Forgetting the possible combinations of positions of both slides, the combination of positions along one slide alone, even allowing for hole spacing, amounts to a fantastic number which

we haven't bothered to compute. A small jig borer can assume something like 180,000 x 120,000 positions, and a rotary table 1,296,000 (1 second) positions. How does one attempt to measure and control the accuracy so that the distribution of positioning errors does not exceed a predetermined amount a predetermined number of times?

Here is where sampling techniques come to our aid. With such means at our disposal, we can adequately examine the capability of a machine tool slide with from 50 to 60 random measurements.

Improvement always possible

So far, all the statistical methods referred to could apply to any product, any field, but they do have definite application to the machine tool field. Although we in the machine tool business take pride in the accuracy of today's large and complicated machines, the demands of our customers give no indication that we can stop improving this accuracy. As we advance in the science and mechanics of machine building, we are finding that the seemingly impossible task of achieving greater and greater accuracy is really not impossible. If we examine two more important elements of variation perhaps we will see how improvement is always technically possible.

First, two or more independent variations acting simultaneously to produce a total variation *do not* add up directly to equal the total. To illustrate, a variation of

$3\sigma = \pm 0.000{,}25$ in. (99.7%)

due to inherent variation in a machine, plus a variation of

$3\sigma = \pm 0.000{,}25$ in. (99.7%)

due to positioning successive parts in the machine *do not* add up to a total variation of

3σ (total) $= \pm 0.0005$ in.

Rather, variations add as the square root of the sum of their sigmas squared:

If, in the example, both variations are normally or nearly normally distributed, then the sigma for each would equal 0.000,25/3, or 0.000,083 in., the square root of the sum of the squares would equal 0.000,12 in., and 99.7% of all deviations occurring as a joint effect of these individual variations would equal 0.000,12 x 3, or $\pm 0.000{,}35$ in., less than half again as much as either component.

Second, no two variables contribute equally to the total end result. In any machine tool there are bound to be several sources of variation. And though each source contributes to the total variation, the contributions are not of equal magnitude. Rather, experience has shown that the major contributor usually accounts for approximately one-half of the total variance. (In a typical case we found that the tool-slide was responsible for about 51% of the total variance of a machine.)

This being the case, it becomes quite clear that to improve the total accuracy (reduce the total σ^2), we must identify the major contributors and concentrate first on reducing them. Generally, the biggest contributor accounts for about one-half the total, so if we can cut this factor in half, we will have reduced the total variance by 25%. Remember, we are talking variances, σ^2, not plus and minus 3σ variation. A 25% reduction in σ^2 is only a 13.4% improvement in $\pm 3\sigma$.

AM's editor gets first NTDMA Distinguished Service Award

First presentation of the National Tool and Die Manufacturers' Association's Distinguished Service Award, climaxing the Association's week-long 14th annual meeting at New York's Statler-Hilton Hotel November 4-8, was made to Burnham Finney, editor of AMERICAN MACHINIST, for outstanding contributions to the tool and die industry.

In presenting the Award, in this case an atmospheric clock, Jack Kleinoder, outgoing president of NTDMA, cited Mr Finney's personal efforts and those of AMERICAN MACHINIST in publishing technical articles for the benefit of the industry, and in publicizing the activities of the Association over the years—"He is known throughout American industry as a proponent of equipment replacement and plant modernization. Because of this, the tool and die industry has been the beneficiary of industrial activity along these lines that has been stimulated by his many articles, editorials and speeches covering the subject [which] have done much to help upgrade the tool and die industry because of the technical and management assistance they have given the members."

For outstanding service to the industry . . .

Burnham Finney (right) editor of *American Machinist*, became the first recipient of the National Tool and Die Manufacturers' Association's Distinguished Service Award in a ceremony November 7 climaxing NTDMA's 14th annual convention in New York. Presenting Mr Finney with a perpetual atmospheric-pressure-operated clock is Jack Kleinoder, general manager of Volkert Stampings Inc, Queens Village, L. I. outgoing NTDMA president

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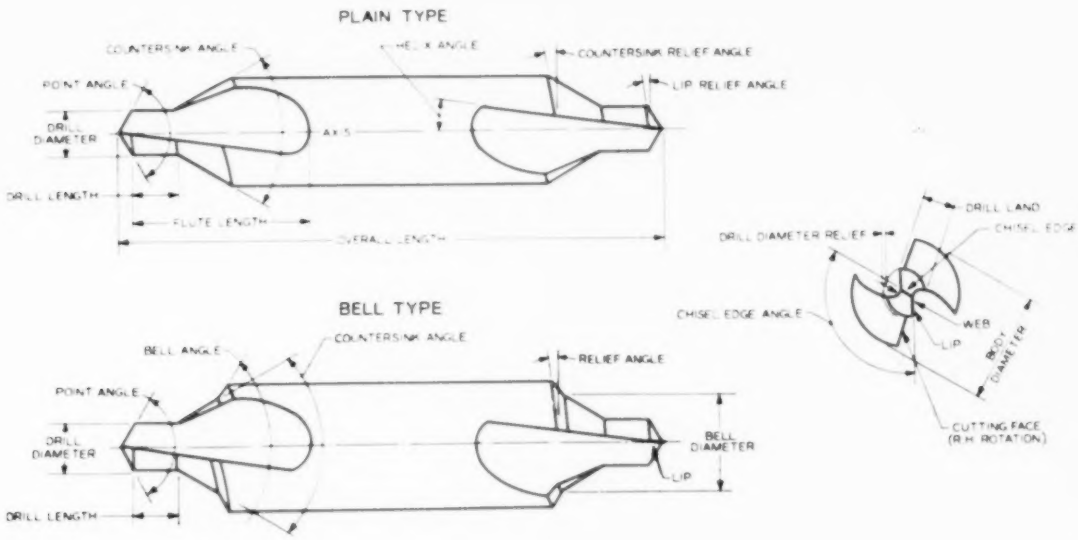
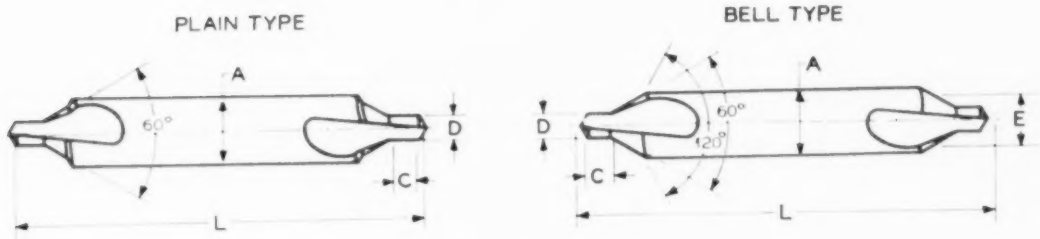
CIRCLE 228 READER SERVICE CARD

Combined Drills and Countersinks

Source: American Standard ASA B5.12—1958, published by the American Society of Mechanical Engineers, N Y





General Dimensions of Combined Drills and Countersinks, Plain and Bell Types

Size Designation	Body Diam.	Drill Diam.	Drill Length	Overall Length
	A	D	C	L
1	1/8	3/64	3/64	1 1/4
2	3/16	5/64	5/64	1 7/8
3	1/4	7/64	7/64	2
4	5/16	1/8	1/8	2 1/8
5	7/16	3/16	3/16	2 3/4
6	1/2	7/32	7/32	3
7	5/8	1/4	1/4	3 1/4
8	3/4	5/16	5/16	3 1/2

Size Designation	Body Diam.	Drill Diam.	Drill Length	Overall Length	Bell Diam.
	A	D	C	L	E
11	1/8	3/64	3/64	1 1/4	.100
12	3/16	1/16	1/16	1 7/8	.150
13	1/4	3/32	3/32	2	.200
14	5/16	7/64	7/64	2 1/8	.250
15	7/16	5/32	5/32	2 3/4	.350
16	1/2	3/16	3/16	3	.400
17	5/8	7/32	7/32	3 1/4	.500
18	3/4	1/4	1/4	3 1/2	.600

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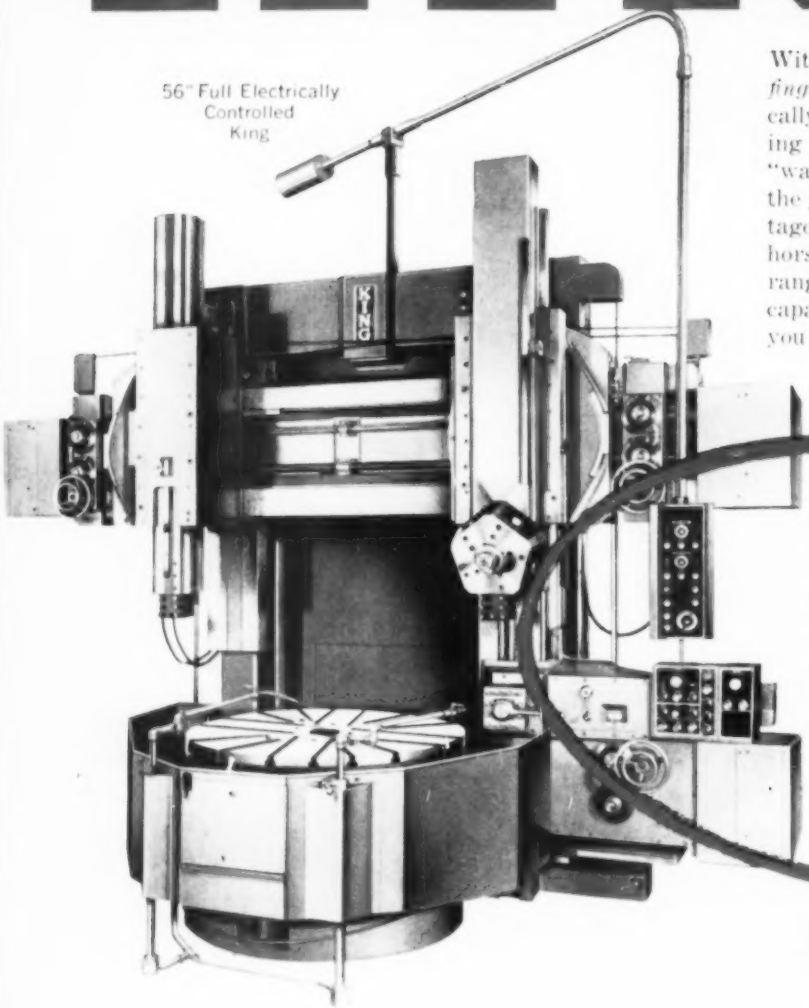
KING



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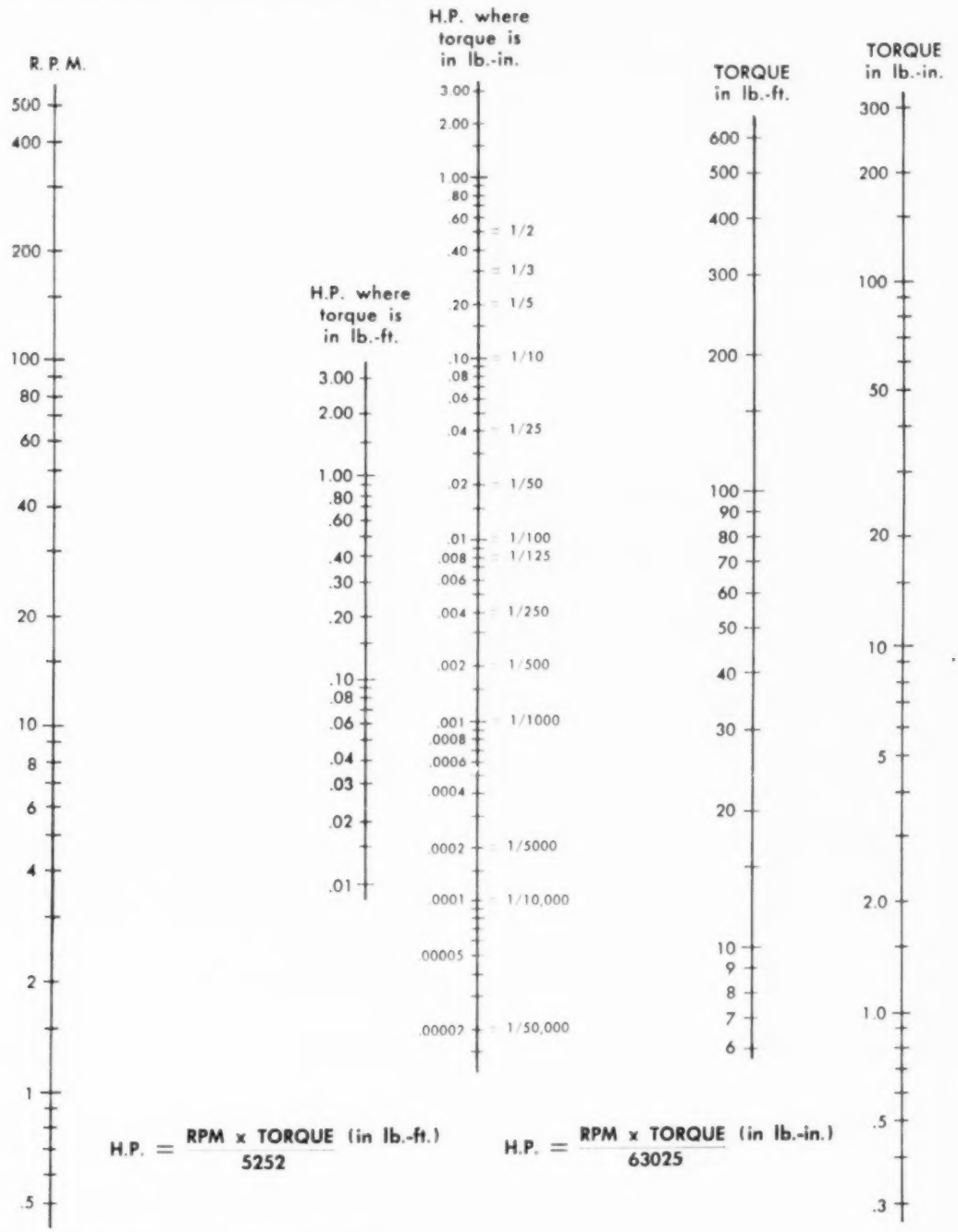
KING Vertical Boring and Turning Machines

American Machinist
REFERENCE BOOK SHEET

Horsepower Nomograms for Motors and Transmissions

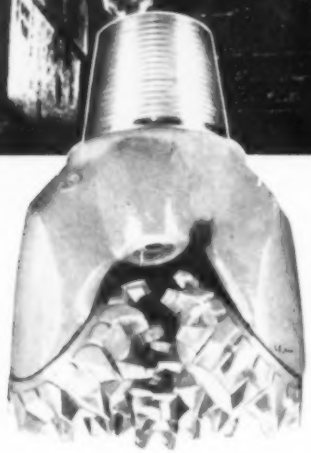
By Harry D'Almaine, Merkle-Koff Gear Co, Chicago



$$\text{H.P.} = \frac{\text{RPM} \times \text{TORQUE (in lb.-ft.)}}{5252}$$

$$\text{H.P.} = \frac{\text{RPM} \times \text{TORQUE (in lb.-in.)}}{63025}$$

Photograph courtesy of Pacific Forge, Inc., Fontana, Calif.



Of course Pacific Forge is fussy about surface condition

On drill bits for Security Engineering Division, Dresser Operations, Inc., Aristoloy round-cornered squares meet this forger's stringent requirements. In-plant scarfing and grinding prior to forging have been eliminated—rejects caused by surface defects have been reduced to a minimum.

The secret—careful control of Aristoloy Steels from electric furnace melting to final rolling operations. The result—alloy steels of prime forging quality—and uniform chemical, structural, and hardenability characteristics that satisfy the critical use requirements for rock drill bits.

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Nodular Iron Gear Materials

A tentative standard of the American Gear Manufacturers Association, Washington, D.C.

These specifications cover gear blank castings made of nodular iron, also known as ductile iron, which is iron having the graphite substantially in spherical shape.

Gear and pinion castings requiring less than 210 Brinell hardness shall be annealed or stress relieved as specified. When no hardness is specified, use 180 minimum Brinell hardness.

Castings shall be free from harmful porosity, shrinks, cold shuts, cracks and other defects which make the casting unsuitable for the intended use.

Heat Treatment. Unless otherwise agreed upon, gear and pinion castings should be annealed or normalized and tempered to meet 210 through 245 Brinell minimum hardness. For castings 255 Brinell and higher, heat treatment shall consist of an oil quench and temper. Tempering shall be at a suitable temperature to obtain the hardness specified.

ASTM Specification A 339-55 covers physical tests, if needed.

Surface Hardening. Gears and pinions may be flame or induction hardened when specified. Specification should include:

(a) Pattern of Hardening. This varies with the pitch of the tooth and method of hardening:

(b) Surface Hardness. Brinell hardness 450 minimum for maximum surface hardness. It is recommended that surface hardness should be a minimum of 450 Brinell.

(c) Core Condition. Usually soft cores call for a maximum of 390 Brinell surface hardness. The material hardness before surface hardening should be a maximum of 390 BHN.

(d) Heat Treatment. After surface hardening, heat treatment will be based on application. Usually surface hardness of over 475 BHN calls for stress relief at 300 to 400 F.

Table 1—Recommended Tooth Hardnesses

Gear Hardness* BHN, Min.	Pinion Hardness* BHN, Min.
Note 1	210
210	245
225	265
245	285
255	300
270	315
285	335
300	350

Note 1—See paragraph on annealed or stress relieved castings for hardness less than 210 Brinell.

* Brinell ranges, when specified, shall be 40 Brinell numbers minimum up to 400 Brinell, and 50 Brinell numbers minimum over 400 Brinell.

Table 2—Typical Nodular Iron Properties

Brinell Hardness Number, Min. (Note 1)	Heat Treatment	Tensile Strength Min., psi	Elongation in 2 in., Min., %
165	Anneal or	65,000	21
180	stress relieve	75,000	17
210	Normalize and draw	87,000	9
225	Normalize and draw	95,000	6
255	Oil quench and temper	120,000	5.5
265	Oil quench and temper	125,000	5
285	Oil quench and temper	130,000	4.5
300	Oil quench and temper	140,000	4
350	Oil quench and temper	160,000	2

Note 1—See paragraph on annealed castings, for hardness less than 210 Brinell

Inspect your gears the practical, low-cost way

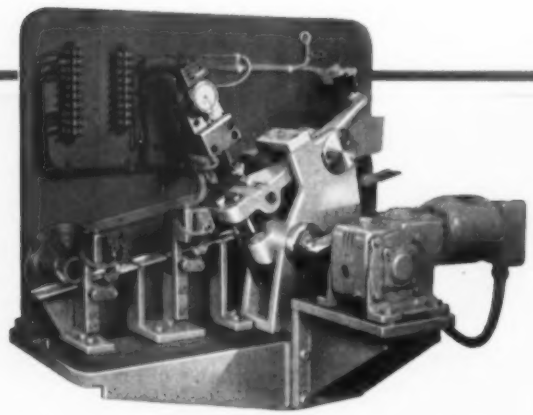
Many gear makers favor Red Ring gear inspection machines because they are precise without being delicate or temperamental — equally effective in either the gear laboratory or the busy production shop. Just practical and economical.

Red Ring machines provide for such Automatic Operations as:

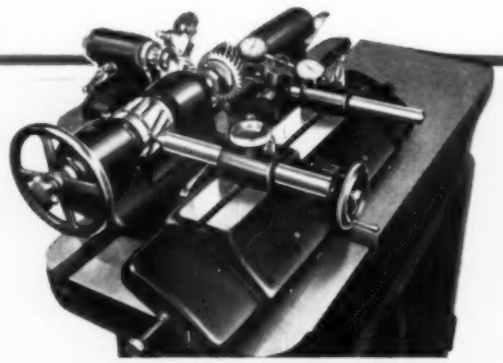
- Gaging of size and helix angle
- Sorting according to size and helix
- Recording of gear measurements

Red Ring machines also check such individual gear characteristics as Index, Eccentricity, Wobble, Lead or Helix, Size and Tooth Parallelism.

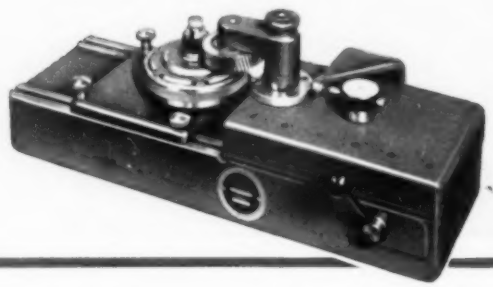
We can't show here the many models now in service throughout industry, but you may have Bulletin C-55-9 which describes them in detail. Why not write for it today?



Automatically checks tooth size of gears with integral flanges too large to pass through conventional feed chutes. In-tolerance, oversize and undersize parts are segregated. (Machine cover removed)



Lead Comparator with an additional interchangeable head for measuring other tooth characteristics. (Tooth spacing head shown)



Rolling fixture provides a rapid check of composite errors and tooth surface roughness.

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The information is based on the experience of our many field service men whose jobs are to help customers fabricate "T-1" Steel. It contains the results of nine years of work with hundreds of users, and shows how to apply common practices in the welding of "T-1" Steel.

As the booklet points out, welding of USS "T-1" Steel is not particularly difficult—but it is different than welding most other high-strength structural steels. To do it correctly requires some basic knowledge of the metal, of the electrodes, and the proper welding procedures.

We'll gladly send you enough free copies of the booklet for your weld shop personnel. Just send the coupon.

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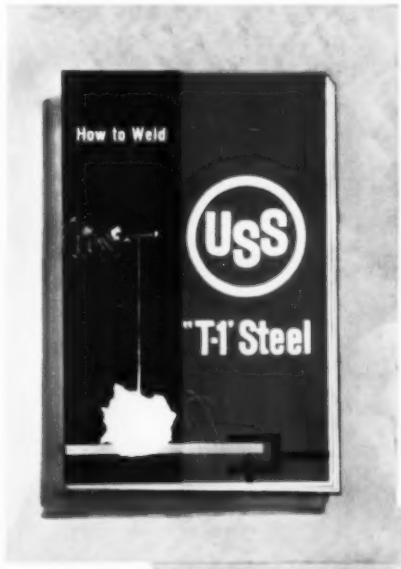

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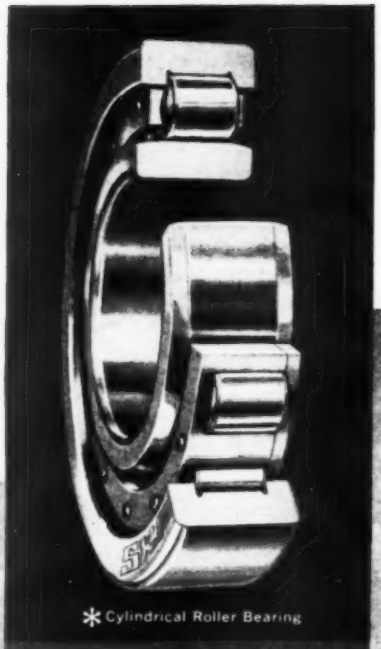
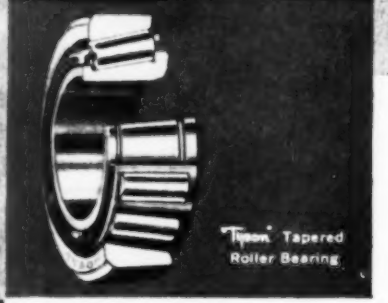


*Cylindrical Roller Bearing

Single Row Deep Groove Bearing

Spherical Roller Bearing



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Spherical Roller Thrust Bearing

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Yet this is SKF's standard cylindrical roller bearing, promptly available in 154 sizes ranging from just under 1" to 6" (bore). In the double row it's 1" to 9.5".

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EVERY TYPE EVERY USE

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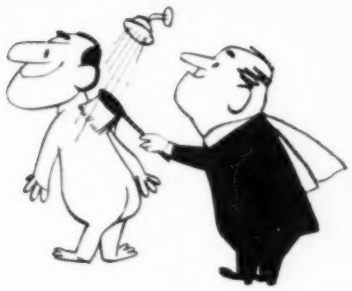
Talking Shop...



Whose Shower?

WHEN A PERSPIRING employee takes a shower before going home from work, whose interest is it in: his or the company's? This question came up in Colorado when a workman slipped and fell in the shower. The state supreme court overturned the decision of the lower courts and ordered injury benefits. "The fact that the employer provided showers and that nearly all employees find it necessary to use them is persuasive evidence . . . the health of the employee is of interest to the employer." The decision overturned an 18-year-old doctrine on workmen's compensation.

Troubleshooting Job

DISASTER LOOMED at Norair when some castings of 17-4 PH failed to respond correctly to heat treatment. Analysis showed the villains to be carbon and nitrogen, and tracing back the history of the castings turned up the cause: carbon arc melting at the foundry. The foundry switched to induction melting. Case closed.

Precedent

YOU'VE PROBABLY heard it said that most of the innovation in manufacturing method originates in the aircraft industry. We, for one, have been saying it for years. This is partly because the greatest problems exist there and partly because the manufacturing engineers in aircraft have a tradition of being willing to try anything—no matter how idiotic it seems—once, at least.

But a major reason is that the U S Air Force serves as a great underwriter of manufacturing research. Many a strange idea has been tried first with Wright Field paying the bills. Most of these contracts go to aircraft or missile builders and their established subcontractors. Most machine tool builders have the feeling that they stand no chance of getting development contracts.

This all lends point to a Spot News item we carried in the last issue: Sheffield Corp has just been awarded an Air Force development contract for work in ultrasonic machining. Granted that Sheffield is a division of Bendix Aviation, it is still a machine and gage builder. And we'll bet that if you have a manufacturing idea that is worth investigating, are willing to devote the needed resources to it, and will accept the small profit that goes with development contracts, you can get a sympathetic hearing from the men at Wright Field, too. Too many people tell us the Air Force won't talk to them, when they haven't tried.

Half Honeycomb

RYAN AERONAUTICAL is having success with a "foil" for structural parts that is a bit like honeycomb with one face left off. To a thin skin an even thinner corrugation is spot-welded on one side. Called Mini Wate, the material is used for hot parts that have light structural requirements such as tailpipes. This construction avoids blind attachment points and greatly simplifies the manufacturing—saves money, too.

Missile Iceberg

MISSILES LOOK small and lonely, even the biggest of them, when you see them heading out into the stratosphere. But we're just beginning to realize that missiles have a lot in common with the iceberg, most of which doesn't show. To launch one Douglas-built Thor missile requires 150 pieces of ground support equipment with 17,000 vendors having contributed parts to the missile or ground equipment. To handle one squadron of Thors (15 launch emplacements) requires 10 miles of piping, 2500 miles of wire, 1500 meters, 3000 panel light assemblies, 50,000 resistors and potentiometers, 50,000 capacitors, 5000 relays, and enough electricity at peak output to supply a community of 25,000 homes.

New Word

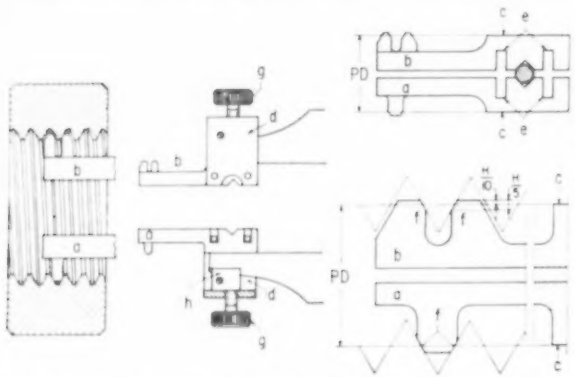
KNOW WHAT ABLATION means? Our dictionary says it has to do with the removal of organs or growths by surgery, but a new sense of the word is finding growing use in metalworking. An ablation material is one that absorbs large amounts of heat by vaporizing on the surface while the interior portions retain structural integrity. It represents a fresh approach to the problems of high-temperature application. If successful, it may get us into the working of some rather strange materials in the shop. Just to make it clear that not all advanced research is sponsored by the Air Force, the work in ablation materials is being done by Aeronutronic, Div of Ford Motor Co, under a Navy contract.

Big Reel

WELDED STAINLESS sandwich has been produced in a setup at the Missile Division of North American Aviation. Core is formed on a Yoder roll forming machine in strips 5 in. wide with 65 corrugations each. This core is wrapped on a reel 8 ft in diameter. After six strips have been wound in adjacent positions on the reel, all six strips are fed from the reel to the welder. The 8 ft dia is required for cor › 5/32 in. in height. As core height is increased the radius required to reel the core without damage also increases. Some enterprising soul at North American has calculated that core (0.002 in. thick) corrugated to a height of $\frac{3}{8}$ in. would require a reel 21 ft in diameter.

Practical Ideas...

Vernier Caliper Thread Ribs Measure Inside-Pitch Diameters



In an earlier issue (AM—July 27, '59 p131) a method was shown for measuring pitch diameters of threaded parts by means of thread ribs attached to a vernier caliper. The same principle may be employed on internal threads by use of the ribs being shown here in detail and applied to a workpiece.

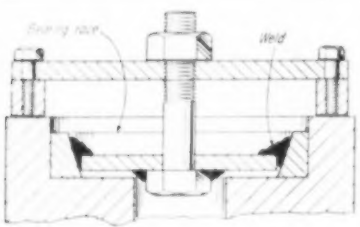
Although similar, in that they are both attachments used on vernier calipers, they differ with respect to simplicity of operation. Where the thread ribs for gaging OD threads require some calculations to compensate for the rib thickness, the internal-thread ribs do not. These ribs, a and b, enable the operator to take readings directly from the calipers because the surfaces c, which bear against the caliper jaws, are ground to lie exactly on the pitch line.

Here, as with external-thread ribs, you'll need a different set of ribs for each pitch you want to measure. But you can get along with one set of clamps, d, for all the ribs. These clamps are each drilled to accept pins which engage slots e in the ribs. The contact surfaces of the lugs f should be approximately $\frac{H}{5}$, or $\frac{H}{10}$ above and below the pitch line.

On each rib is a 90° V into which a roll is inserted to position the lugs on the same axis parallel to the direction of measurement. As the roll is held by closing the vernier jaws, tighten thumb screws to apply pressure on blocks h which are shaped to fit the rounded surface of the jaws.

You are now ready to insert the ribs into a threaded bore. Next, open the caliper jaws and engage the thread at its largest diameter, the point at which the ribs will not move sidewise. The reading you now find on the caliper is your pitch diameter.

Charles Minaire, St Etienne, Loire, France



Welding Makes Easy Work of Pulling a Bearing Race

We recently had to replace a large roller-thrust bearing, but ran into trouble when we tried to remove the old outer race. There was no way to get under it so it could be pressed out and, being inside tapered, we couldn't get a grip on it from the end either.

The solution was found by pulling it out with a disk welded to the race. We machined the disk slightly larger than the smallest of the race's inside diameters and welded a heavy bolt into a centrally located hole. Dropped into the race, the plate was then welded securely to its inner surface. While allowing the weld to cool, which also caused to race to contract, we rigged up a strongback on spacer blocks. This made it an easy matter to pull the old race out of the bore to make room for the new.

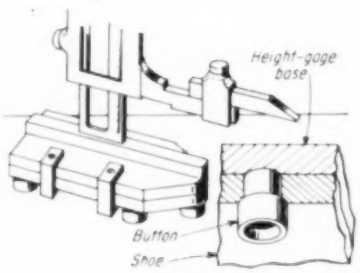
R O Peloquin, machine shop foreman, Owens-Corning Fiberglas Corp, Ashton, RI

A Height Gage Slip Shoe

The name of this tool could be construed to describe a shoe which is easy to slip onto a height gage. This is true, but its main function is not to decorate the height gage, instead it's designed to make the height gage easier to shift from one position to the next on the surface plate. Hence the name.

The tool is a direct result of numerous situations when I had difficulty moving the height gage on the cast-iron plate for both inspection and layout work. Suction caused by the contact of the perfect gage-base surface and the plate created no end of aggravation. I tried powdered lubricants and graphite, but found little satisfaction because the mess was only a choice of a lesser evil.

Reduced contact surface was therefore the obvious answer. I accomplished this by the shoe illustrated. It consists of a hardened and ground steel plate, cut out to the contour of the gage base, and fitted with five buttons which were hollowed out to further reduce surface contact. Next, four small C-clamps were made with which to attach the shoe to the gage base. Each was provided with a headless setscrew for clamping.

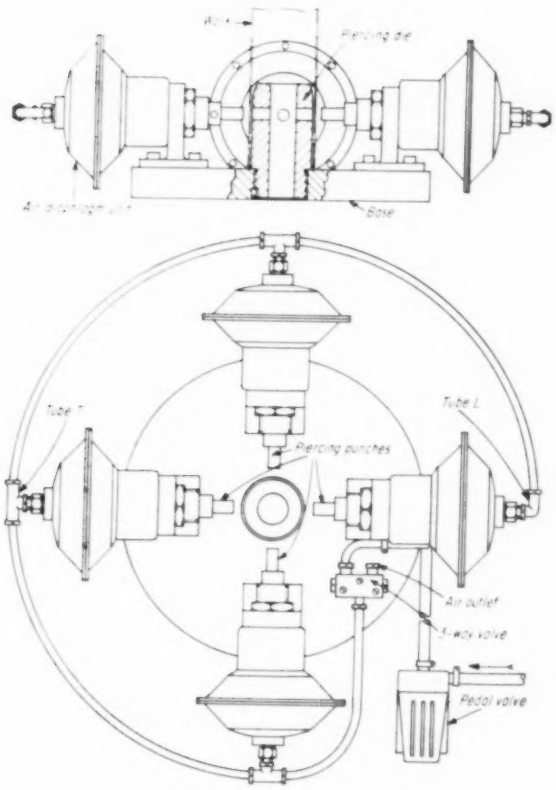


After all parts had been hardened and tempered, the plate was ground on both sides and the edges polished. The buttons were then inserted and ground parallel with the mounting face of the shoe.

Compensation for the height of the shoe, should it be necessary to take dimensions from the surface plate, can be simplified by making the shoe height a round figure like 0.400 or 0.500 in. Another way is to make an offset scriber with a step equal to the amount the gage is raised.

Frank J Schiller, Poughkeepsie, NY

Pneumatic Device Replaces Punchpress



This piercing fixture does the same efficient job an expensive die is capable of doing on the same class of work. Add to this its ease of operation (in loading, activating, and unloading) and the fact that it's self-powered and you have an economical stand-in for a punchpress.

The tool has been developed in our shop to pierce four equally-spaced holes on the same level in short lengths of tubing. Each punch is powered by an air unit located on a circular base plate with a vertical bracket. Punches are positioned by the location and height of these brackets and, because of this, many variations of identical applications are possible.

The die is what might be called a hollow stud arbor, chamfered at the top for easy loading, and concentrically mounted on the base plate. After hole locations have been laid out, drilled, and reamed, the die is again inserted and positioned to drill and tap for a grub screw into the bottom. Die is then hardened.

Tubing is used to hook up the units in series, making connections with tube T's on three of them, and a tube L on the fourth. A three-way valve, mounted on the base plate, alternately and automatically channels air to the units when applied, and bleeds them when supply is shut off. A foot-pedal valve controls the supply from the shop air line.

In operation, the work is slipped over the die and allowed to rest on the base. The foot valve is then depressed, sending air to the units activating diaphragms which push the punches forward and through the work. Upon releasing the foot valve, air is bled through the three-way valve permitting the punches to retract, which they do with the aid of compression springs inside the units.

Hjalmar Dahl, Upplands Vasby, Sweden

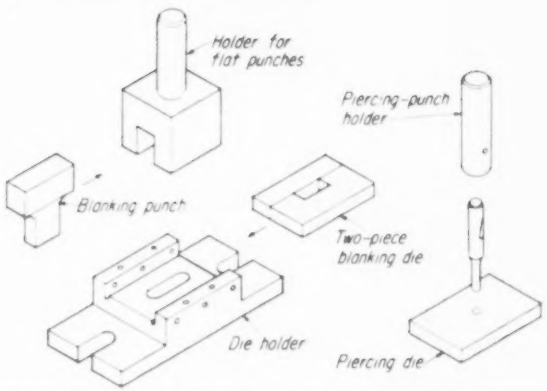
Standardization Adds Life to Experimental Tools

Small punches and dies are necessary tools in the experimental shop. When such tools are used in prototype work they are generally made by the mechanics themselves who, after the tools have served their usefulness, discard them. Over a period of a year, this can constitute a considerable expense in labor and material.

This is why we have standardized most of the tooling so it will be necessary only to make the punch and die to produce a particular part. A typical approach to this end is shown in the sketch. Here we have as the basic parts a punch holder and a die holder. Shown also are two of the most common types of punches and dies we use.

A set of these holders are now standard equipment with every man in our shop. As punches and dies are required, they are made to fit the holders. One die holder is generally enough to take care of all dies whether they are square, rectangular, or round-hole dies. But for punches we use two types of holders. Round, or piercing, punches are held in a plain adapter which fits the press ram; others are mounted in a clamp-type holder.

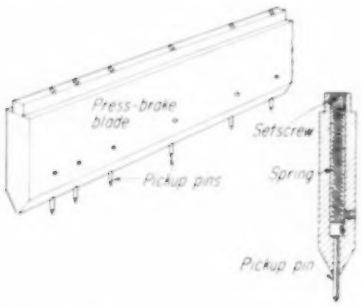
Two U-shaped slots are machined in the ends of the



die holder for bolting it to the press table. The die nest is ground parallel with the holder's bottom face and provided with edge reliefs and a slug-clearance hole. Three screws on each side hold the dies in place, and two screws on top of each side rail are for attaching a stripper plate when necessary.

K Haller, Millington, NJ

Practical Ideas...



Pickup Pins Improve Braking Technique

While operating a press brake, it is sometimes difficult to control accuracy during the bending of a sheet-metal part to a laid-out line. This is usually caused by either or both of two circumstances. The layout line is hidden as the blade descends, or an involuntary muscular movement shifts the work before actual contact of the blade.

Therefore, something had to be done to prevent the possibility or rejections resulting from these shortcomings. We feel we have found the solution with pickup pins inserted in the brake blade. These pins not only make it easy to align the work with the brake blade, but they also add a safety feature to the braking operation. As the work is positioned under the pins, they exert enough pressure on the work to allow the operator to remove his hand before completing the press stroke.

Holes for the pins are drilled and counterbored through the centerline of the blade. The top or large end of the holes are tapped to accept headless setscrews which are used to apply tension on compression springs. Small holes are drilled and tapped into the counterbores from the side of the blade for screws to hold pins in retracted position when so desired. At the most convenient position on the brake, the pins are more closely spaced than on the rest of the blade for small-work braking.

The pins are turned with a slightly rounded point at one end and with a sliding fit in the holes. Heads are machined on the other ends, but the OD of these can be a few thousandths smaller than the counterbores. As a finishing touch the pins are hardened, because we have found that it's better that a pin breaks than having it bend.

Medium - tension springs are dropped into the counterbores to rest on the pin heads in final assembly. These springs should be long enough to apply pressure on the pins when the setscrews enter.

Wm Toivola, Jupiter, Fla

Tap Chuck with Leadscrew Insures Start and Alignment

One of the toughest operations in machining magnesium is probably that of hand tapping a hole. Unless you are equipped to maintain alignment and provide, at least, a starting feed for the tap, you will often find that before the tap takes a hold the first one or two threads are chewed up.

To eliminate this hazard, I've made the illustrated tap holder which can be used in a lathe, drillpress or any other machine not having an accurate lead screw or where the use of such a feed would become a major operation. Mounted in a drill chuck, this tool gives me the two things required of it; that of alignment with a drilled hole and a cleanly started thread.

Made of bar stock, the tool is drilled and reamed in one end to take the shank of the tap to be used. The other end is drilled and tapped with the same pitch thread and class fit as the tap. A threaded shank is then made to fit the tapped hole; sometimes a bolt, turned down to permit gripping in a chuck, will do. The OD is knurled and a setscrew is provided for holding the tap.

With the threaded shank fully entered in the tap chuck, the tap's point is started in the drilled hole. While all parts of the machine supporting the chuck remain stationary, the chuck is rotated by hand the required number of turns for a good starting thread. The rotation is then reversed to retrieve the tap. This is enough of a start to complete the tapping on the bench.

E Antlitz, Bronx, NY

Frank A Cuthbertson
Milwaukee, Wis

WON

$25 **In addition to regular payment for his idea:**

REFERENCE GAGES SPEED INSPECTION

in the Sept 7, 1959 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

PAYMENT—$25 in addition to regular rates for the items published to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

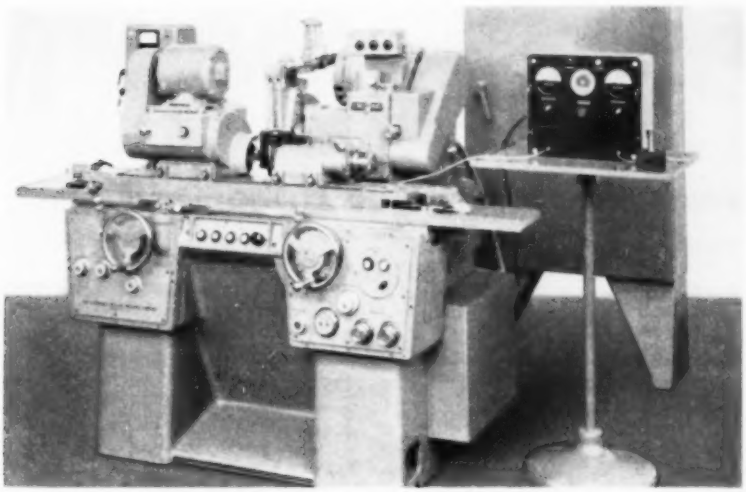
REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N.Y.

New Shop Equipment

Materials and Parts



Grinder With Integral Gaging System Holds Tolerances to Millionths on Mating Parts

Cincinnati 4-in. Super Precision grinder has built-in gaging system for matched hole grinding that holds tolerances of 0.000010 in. for roundness, 0.000020 in. for straightness, 0.000025 for size and 4 microinches for surface finish.

The new Grind-A-Mate gaging system consists of OD and ID air gage units and a high amplification differential meter. Clearance between the mating parts is set on a dial with no need for separate master gages for each clearance setting.

In operation, ID and OD gages are set from masters and clearance is dialed in. The part to be matched is placed on the ID gage and the workpiece positioned between centers. After the OD gage is swung into position, the cycle start button is pressed and the operation proceeds automatically.

Cycle time for average stock removal of 0.0003 to 0.0008 in. is approximately one minute. To grind without mating, the ID gage is inactivated. If matched grinding is not likely to be required, the gaging system can be provided with OD gage only.

The grinder is designed for extreme rigidity and fitted to alignment specifications roughly five times as stringent as those for a standard machine. Base casting has a $\frac{3}{4}$ in. minimum wall thickness, hydraulics are isolated; all motors are super-dynamically balanced; power transmission has been designed to eliminate vibration. Unit is equipped with an electronic device called Gage-Line which continuously checks alignment of centers to control taper.

Thermal conditions are also carefully controlled For example, coolant temperature is regulated by a differential thermostat to two degrees above room temperature. By the time it reaches the work, evaporation has cooled it to workpiece temperature. Variable delivery hydraulic pumps are used to minimize blow-off through relief valves, thus maintaining the ambient temperature of the oil at a relatively low level.

Every function of the operation is under complete control of the automatic cycle, so that any good grinder operator can produce consistently accurate work.

Cincinnati Milling Machine Co, Cincinnati 9, Ohio

MORE DATA? Circle 51, inside back cover

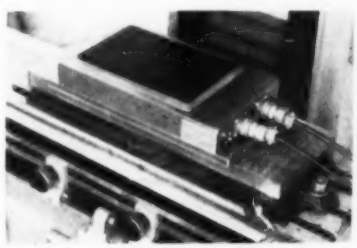
Metal Finishing Process Combines Three Operations in One Machine

Savings in equipment investment and floor space are made possible by new Du Pont process because the three separate stages of metal finishing are combined and use only one solvent during the entire operation —nonflammable Triclene trichlorethylene.

After vapor-degreasing stage is completed, metal parts are given a phosphate coating by spraying with a trichlorethylene-based phosphatizing solution. As parts emerge from the phosphatizing chamber, the solvent evaporates immediately. Metal is dry and ready for painting. In the painting section of the machine, trichlorethylene is used as the sole thinner, providing a nonflammable system.

E I du Pont de Nemours & Co, Wilmington, Del

MORE DATA? Circle 52, inside back cover



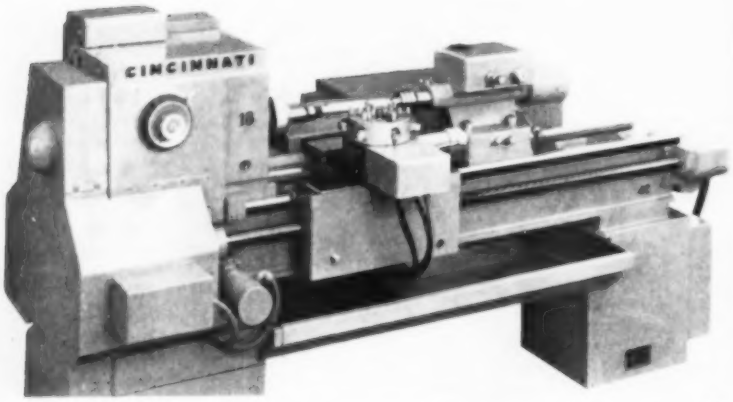
Electrostatic Chuck Offered In New Small Size

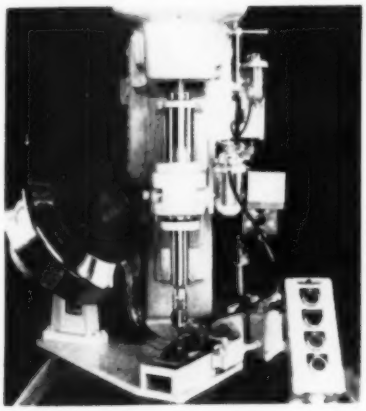
Smaller production model of the Electroforce Electrostatic chucking system (*AM*—Feb 9 '59, p91) which allows precision surface chucking of non-magnetic metals and even non-conductors, is available with 5 x 8-in. work-holding surface.

Developed primarily for use in experimental shops, toolrooms, and for small-run production, new size is comparable in precision performance with the larger units now in use. It is supplied as a complete system with compact power supply, mist dielectric coolant unit, stops, dresser holder, fluids, and recoating.

Electroforce Inc, Fairfield, Conn

MORE DATA? Circle 53, inside back cover





Cincinnati Offers Lowcost Tape Controlled Lathe, Drill

A numerically controlled lathe and a drilling machine with a numerically controlled positioning table are offered by Cincinnati Lathe and Tool Co. The lathe sells for approximately $30,000, the drill for approximately $10,000.

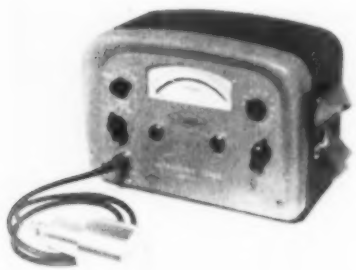
The lathe, designed from the ground up for numerical control, has no manual controls. All functions are controlled electronically or hydraulically from a program tape in the control cabinet of the machine.

Point-to-point positioning control is designed specifically for step turning. Using the six-position tool turret, it is possible to cut necks, chamfers and varying diameters both toward and away from the headstock in an automatic cycle. Tape control handles selection of feeds and speeds, tool sequence and positioning, and length and depth of cut.

The automatic drilling machine consists of an Acramatic control console with tape reader, table unit, pneumatic pack, and a 24-in. sliding head drill. Geared power feed with automatic depth stop and kickout provide depth control to 0.005 in. The table positions the work to tolerances of 0.002 in.

Cincinnati Lathe and Tool Co, Cincinnati 9, Ohio

MORE DATA? Circle 54, inside back cover



Portable Ultrasonic Thickness Gage Weighs Only Ten Pounds

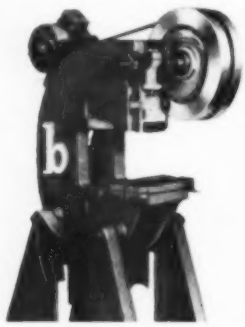
Portable ultrasonic thickness gage weighing only ten pounds can be used for measuring thickness and inspecting corrosion in pipe, storage vessels, hull plates, and other applications. It is equipped with transistors and low voltage batteries.

Measurements may be read on a directly calibrated meter which eliminates using an oscilloscope and charts. Alarm lamps can be set at thickness limits. Once the operator has adjusted the dial for the material being inspected, the instrument reads directly in inches.

Accuracy is 1% of full scale. It can gage a maximum thickness of three feet in aluminum and steel and a minimum of 0.060 in. in aluminum and 0.070 in. in steel.

Sperry Products Inc Shelter Rock Rd, Danbury, Conn

MORE DATA? Circle 55, inside back cover



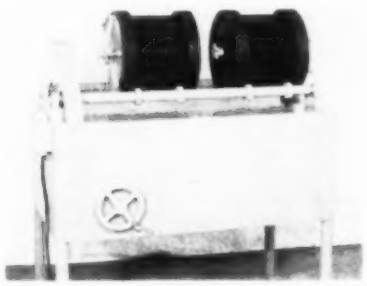
New 8-ton Benchmaster Offers More Die Space, 3 Shut Heights

Series 90 power punchpress is designed for jobs requiring unusual vertical or horizontal die space. A choice of three shut heights with standard 1¼-in. stroke (stroke down) is available: 7¾, 10¾, or 13¾ in. These measurements are without bolster plates. Other strokes of 1½, 2, 2½, and 3 in. can be supplied on order as well as strokes 1 in. and less. Unit operates at 180-190 spm on a direct drive when using a ½-hp 1725-rpm rotor. Bed area is 8 x 11 in. with 12-in. clearance between center of slide and frame.

This OBI unit is available in both direct belt drive and back geared models; geared models develop 40 to 100 spm.

Benchmaster Mfg Co, 1835 W Rosecrans Ave, Gardena, Calif

MORE DATA? Circle 56, inside back cover



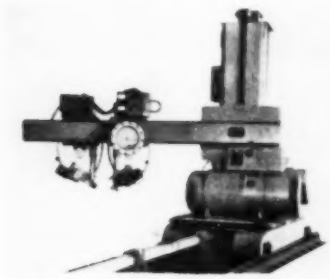
Roll Finishing Machine Introduced by Techline

Unit, offered for small volume precision finishing of small parts such as screws, washers, delicate gears, is available in six basic models as well as larger special sizes.

Machine utilizes octagonal-shaped barrels set on rollers powered by a 1/2-hp 110-v drive. Barrels are made of neoprene, resistant to oils, greases, and most chemical solutions. Up to eight barrels can be run simultaneously on the largest models. Regardless of number of barrels in operation, each can be removed or placed on the rollers with minimum effort for either loading or unloading without shutting off the machine. Caster-mounted separator, same height as the finishing machine, is available with media pans and screens.

Wheelabrator Corp, 1110 Ave V, Vicksburg, Mich

MORE DATA? Circle 57, inside back cover



Welding Head Manipulator Speeds Automatic Welding Operations

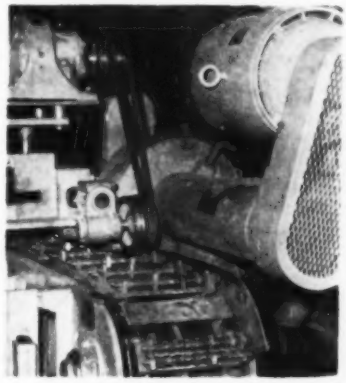
Mechanized unit, named Robot, simplifies welding of large and small, simple and complex contoured products. It can also be used for fillet welding of structural fabrications. Incorporating simultaneous boom, carriage column and base travel, it can be furnished with either single or dual heads for floating or fixed operations.

For floating operation the heads are mechanically controlled to float horizontally along the entire length of the boom and up to 12 in. vertically. Controlled independently or simultaneously, the heads can be rotated radially 360° around the vertical float head shaft and can be locked in any position. Even irregularly shaped pieces can be easily followed and automatically welded with minimum of setup time. To provide straight line welding parallel with the boom, the welding head float mechanism is locked and the cam follower is disengaged. Weld speed is controlled by engaging a variable carriage drive mechanism. Traveling base is also powered and operates at variable controlled speeds for either floating or fixed operation. Column has 360° rotation and brakes lock it in any position. Head, base, and column operation is controlled from operator's control pendant by only one man.

Standard models are available with from 6 to 15 ft of vertical travel and 6 to 20 ft of horizontal arc travel. Speed range is 25-1 with a weld speed of 5-25 ipm.

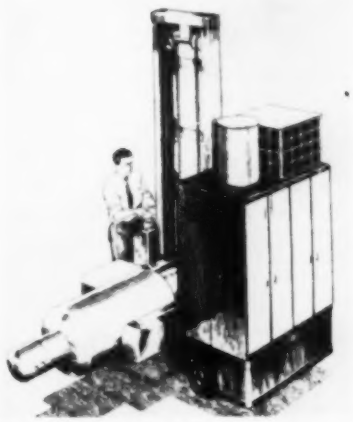
World Electric Co, 4614 Prospect Ave, Cleveland 3, Ohio

MORE DATA? Circle 58, inside back cover



STRAIGHT LINE PRODUCTION GRINDER, operated by one man, grinds 45° chamfer on ends of jet turbine blades at rate of 1140 pieces per hour. It replaces 360 piece per hour hand-grinding operation—*Devine Brothers Co, Seward Ave, Utica, NY*

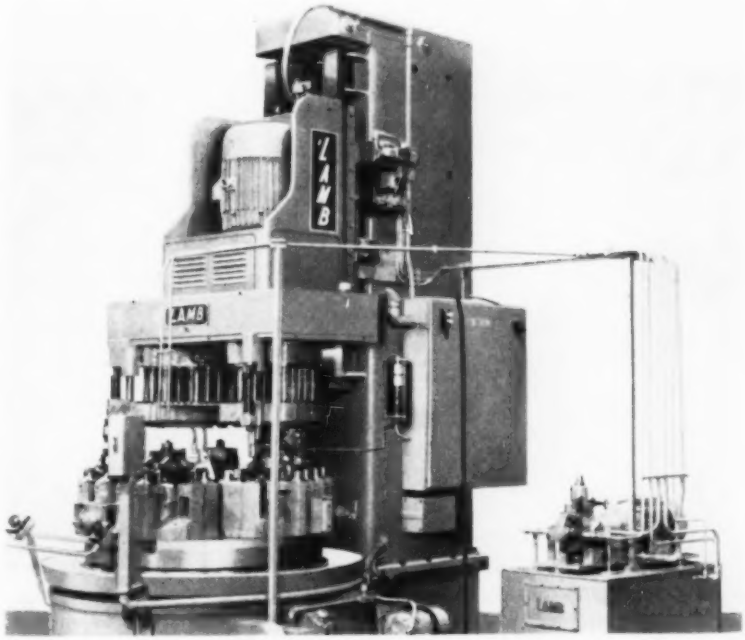
MORE DATA? Circle 59, inside back cover



Linear Accelerator Inspects Missile, Nuclear Assemblies

This microwave linear accelerator, with an energy range of 2 to 8 million electron volts, is designed to inspect the thick steel sections and complex mechanical and electrical assemblies used in the missile and nuclear industries.

Model LR-8 accelerator offers a dual x-ray output of 6000 r per min from a 5 mm focal spot and, for greater precision, 1500 r per min from a 1 mm focal spot, with intensities measured one meter from



THREE-STATION DIAL TYPE INDEX MACHINE drills and reams four 4½-in. deep holes in steering rods at a rate of 443 parts per hour. Other parts can be accommodated by using a new fixture and changing the hole pattern—*F Jos Lamb Co, 5663 E Nine Mile Rd, Detroit 34, Mich*

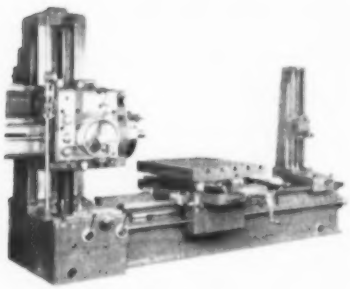
MORE DATA? Circle 60, inside back cover

the source.

Electron energies are continuously variable from 2-8 Mev. At the maximum, the intense output of the machine permits exposure times only 1/10 as long as comparable units, according to the manufacturer. The LR-18 can be permanently installed on an overhead crane mount or can be truck mounted for greater mobility. Price is approximately $150,000.

High Voltage Engineering Corp, Burlington, Mass

MORE DATA? Circle 61, inside back cover



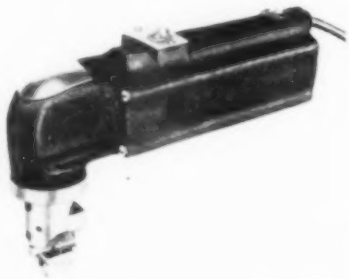
Italian Table Type Boring Mill Has 16 Spindle Speeds, 16 Feeds

The Pasquino (Italian) 3-in. boring mill is a heavy duty table type unit with 16 feeds and 16 spindle speeds from 12.5 to 1500 rpm.

The directly driven nitrided and ground spindle runs in roller bearings at both ends. All headstock gears are also hardened and ground. Other features include: One-piece cast column, built-in threading, rotary table, rapid power traverse, and automatic lubrication.

Index Industrial Corp 606 Madison Ave, NY 21 NY

MORE DATA? Circle 62, inside back cover



8-lb Nibbler Cuts 14-Gage Stainless Steel

Model MN cuts 14-gage stainless and 13-gage mild steel without distortion, either side. Unit cuts inside circles, squares, odd shaped holes in any kind of inaccessible place. All edges are reported to be smooth with no chipping, binding, flaking, or curling; original contour of ferrous or non-ferrous metals is preserved. Tool can be used on copper, brass, aluminum, mild stainless, galvanized and corrugated steel.

Fenway Machine Co, Philadelphia 32, Penna

MORE DATA? Circle 63, inside back cover

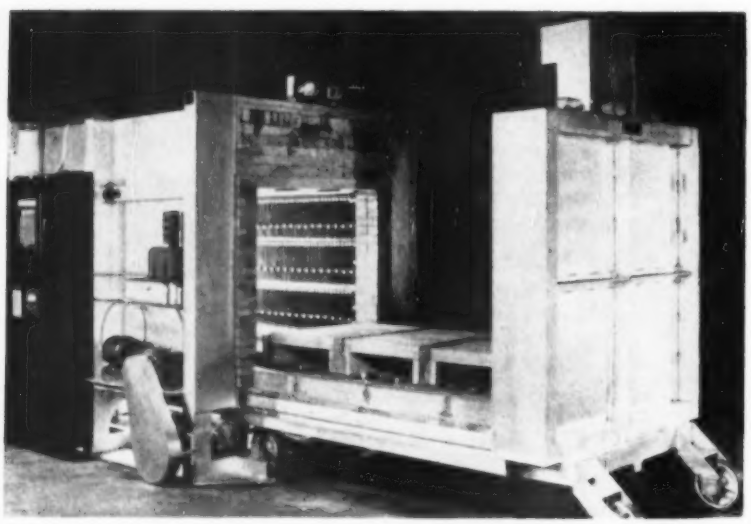
New Ultrasonic Cleaning Machine Uses Vacuum to Boost Efficiency

In the Technochemie ultrasonic cleaning machine, made up of five modular units, a vacuum is used in the cleaning stage to "boil out" the air disolved in the cleaning fluid and thus increase cleaning efficiency. When air is present in the cleaning solution, it acts as a buffer between the solution and the part and reduces the scrubbing action.

Called Personic, the machine is available in any combination of the following modular units: pre-rinse, ultrasonic vacuum cleaning, after-rinse, vapor degrease, drying. Generators can be supplied to provide either 40 or 400 kc.

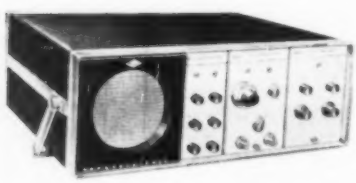
Dist by Carl Hirschmann Co, Inc, 30 Park Ave, Manhasset, NY

MORE DATA? Circle 64, inside back cover



SELF-CONTAINED CAR-BOTTOM FURNACE is 3 ft wide, 3 ft high, 6 ft long. It may be moved intact whenever necessary. Car is motor-driven by rack and pinion gear; additional wheels pick it up as it runs inside the furnace. Heating elements which draw a max of 100 kw are mounted on side walls, back wall, door, and the car, and connect to a 440-v 3-phase 60-c contactor. Leeds & Northrup Model S strip chart recording instrument (left) controls the furnace which operates efficiently at 1800 F—*Waltz Furnace Co, 1901 Symmes St, Cincinnati 6, Ohio*

MORE DATA? Circle 65, inside back cover



Unitized Instrument Developed For Ultrasonic Flaw Detection

UM Reflectoscope that provides maximum flexibility in flaw detection through lowcost interchangeable plug-in units features a building block method that permits selection of only the necessary components for a testing job and provides a means for adding to instrumentation to meet increasing or changing requirements.

Portable unit is approx 7½ in. high, 20 in. wide, 20 in. deep, and weighs about 35 lbs. Basic instru-

New flat rod makes accurate measuring easier

Gets Closer to Shoulders because rod is flat . . . permits measuring at side of hole to avoid extra depth made by drill point. Better for narrow recesses, too.

Won't Walk Away. Flat rod can be turned 360° to any position to suit job . . . but once set, rod won't turn while measuring . . . won't walk away from setting.

Broader, Heavier Base. Extra metal and weight make this micrometer depth gage more perfectly balanced. Available in base sizes of 3", 4" and 5" with complete range of rod lengths . . . numbers 613, 614 and 615.

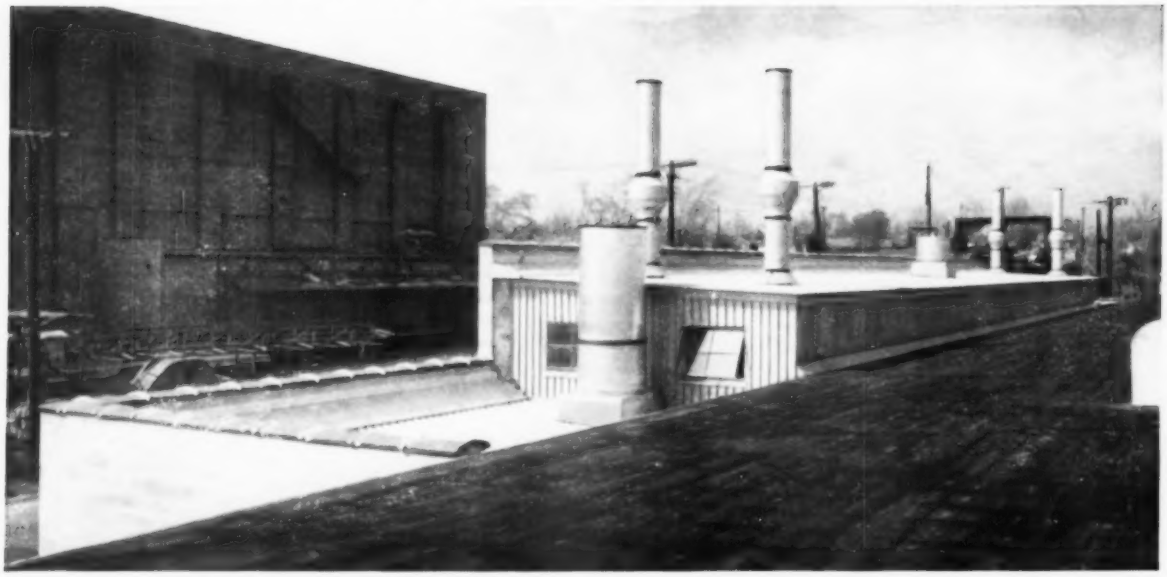
Always buy from your Lufkin distributor. He knows precision tools. His stock is maintained to fit your needs. He is always ready to give you prompt and reliable service.

LUFKIN DEPTH GAGES

TAPES · RULES · PRECISION TOOLS

SAGINAW, MICH. · MIDDLETOWN, N. Y. · BARRIE, ONT.

FINISHING SYSTEMS...



Stout Sign Company Eliminates Production Bottleneck with Conveyorized Paint Baking Equipment!

In the two ovens above, installed at Stout Sign Company, St. Louis, Mo., uniform drying is accomplished by four recirculating zones in each oven. Hot air is forced across the oven by pressure and suction controlled by banks of narrow, vertical apertures in the oven walls which extend from floor to ceiling. These narrow apertures assure even distribution of hot recirculated air, and cause the air to flow horizontally through the sign racks and over the work. The direction of air flow is reversed in each successive zone. Air is recirculated at the rate of 13 oven volumes per minute.

Mahon engineers were called in to solve a paint-baking bottleneck in the production of metal signs painted with the silk screen process. This application process necessitates stacking freshly painted signs in a horizontal position, with only two inches of air space between, in specially built racks. Stout Signs had previously been baked in this manner in batch-type ovens.

The solution arrived at by Mahon engineers was two parallel tunnel-type, conveyorized ovens built as a single unit adjacent to the plant. Each oven was provided with independent temperature and conveyor speed controls and was designed to utilize existing sign drying racks which were modified and adapted to conveyor use.

The Stout Sign Company is now able to control temperature and time-length of the drying and baking process to meet any finish requirements . . . they are relieved of much manhandling of racks, and are free from excessive paint fumes and dust and lint troubles; production flows smoothly, and the quality of finish on their product is vastly improved.

The enthusiasm of a satisfied customer is best evidenced by the following excerpt from a letter recently received from Stout Sign Company: "Let me congratulate you and your entire engineering staff on an accomplishment beyond our expectations."

When you consider new finishing equipment or processing equipment of any type, you, too, will want to discuss your requirements with Mahon engineers.

THE R. C. MAHON COMPANY • Detroit 34, Michigan

Sales Engineering Offices in Detroit, New York, Chicago, Los Angeles and San Francisco

Engineers and Manufacturers of Complete Conveyorized Finishing Systems: Metal Parts Washers, Metal Cleaning and Rust Proofing Machines, Conveyorized Cleaning and Pickling Machines, Dry-Off Ovens, Spray Booths, Electrostatic Spray Enclosures, Flow Coaters, Dip Coaters, Finish Baking Ovens, and Paint Stripping Equipment. Core Ovens, Soldering Ovens, Dehydrating Ovens, Heat Treating and Quenching Equipment for Aluminum and Magnesium. Dust and Fume Control Installations, and Many Other Units of Special Plant and Production Processing Equipment.

See Sweet's Plant Engineering File for Information and Representative Installations, or Write for Catalogue A-659

. . . the **EXPERIENCE** that goes into the **PLANNING** and **ENGINEERING** of **MAHON EQUIPMENT** is the item of **GREATEST VALUE to YOU!**

MAHON

905

THOMSON TAKES EXTRA PAINS TO PREVENT FASTENING HEADACHES!
Statistical quality control procedures plus 100% inspection give double assurance of close adherence to specified rivet dimensions and positive protection against interrupted production.

YOU GET PRECISION FASTENING AT MASS PRODUCTION COSTS...

. . . when Thomson becomes your fastening partner.

In the Thomson line of more than 8,000 rivet designs, you'll find the semi-tubular, deep-drilled, bifurcated (split), shouldered or compression rivet that will give you the best strength-cost ratio in the fastening field. Produced to the industry's highest quality standards at production rates exceeding 20,000,000 rivets a day, these low-cost fasteners merit serious consideration in your product-improvement and cost-reduction programs.

Our leadership in solving fastening problems with quality rivets and precision rivet-setting machines since 1885 is at your service. What is your problem?

JTL

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122 SAWYER ROAD

MFG. CO., WALTHAM 54, MASS.

Rivets and Rivet-Setting Machines

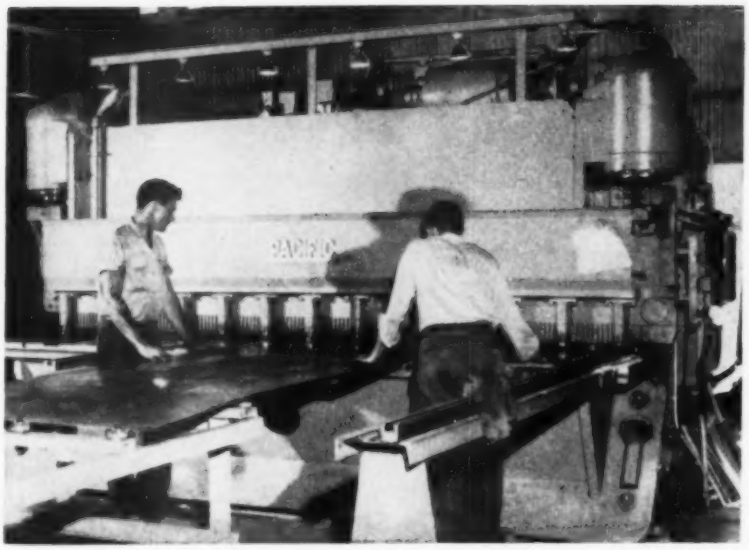
Offices: NEW YORK • ILLINOIS • INDIANA • OHIO • MICH. • PENN. • CALIF. • FLA. • TEXAS • MISSOURI • S. CAROLINA • ONTARIO, CAN.

ment contains three major components: (1) display unit with 5-in. cathode ray tube, display controls, and instrument power supply; (2) pulser/receiver unit; (3) time control unit. Cathode ray tube with full screen bezel is edge-lighted for easier reading. Time control and pulser/receiver are plug-in units with quick disconnect for interchange or servicing.

Many combinations of plug-in units will be made available such as pulser-receivers for various frequency ranges and for quartz or exotic transducers; time control units to meet various testing requirements; alarm and recording attachments; attenuation correction circuits; counting and totalizing channels. The Reflectosope can be incorporated into many types of high-speed flaw detection systems, greatly reducing the cost of instrumentation for automated testing equipment.

Sperry Products Inc, Danbury, Conn

MORE DATA? Circle 66, inside back cover



HYDRAULIC PLATE SHEAR incorporating "cut control" permits a single machine to serve as three conventional shears by providing for adjustment of rake angle, knife clearance, hold-down hammering and tonnage, back gage setting and positioning. This enables machine to cut 20 gage to ¾-in. plate; eliminate twist, bow or camber of light gage metals; cut without marking soft metals; operate at up to 70 spm by remote pedal; slit over-length pieces; and provide for fast efficient positioning of work—*Pacific Industrial Mfg Co, 848 49th Ave, Oakland, Calif*

MORE DATA? Circle 67, inside back cover

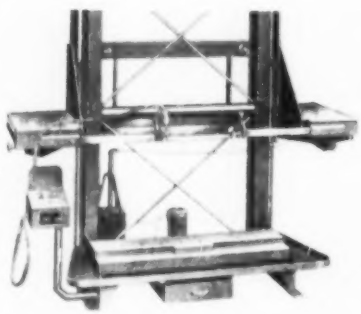
Portable Drillpress Incorporates Vacuum Plate as Base

Tempus Vacuum Drill is designed to permit true drillpress accuracy in areas and with materials previously considered impractical. It can be attached to any material including concrete, wood, plastics, ferrous and non-ferrous metals and is capable of drilling on large aluminum and stainless steel sheets.

In use it is positioned over a center punch mark and vacuum is applied with a switch valve mounted on the base. By mounting directly over the workpiece, greater drilling accuracy is assured. Rubber gasket around the bottom perimeter and a pressed cork scuff pad protect both work and base. Unit can be used in any position, including upside down. Model can be furnished with a special aspirator switch valve for converting air pressure into vacuum or it may be provided with a portable (110-v) vacuum source. Variety of electric drills are available.

Tempus Corp, 1211 Goodman Ave, Redondo Beach Calif

MORE DATA? Circle 68, inside back cover



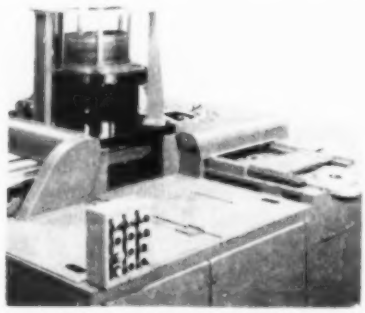
Horizontal Metal Cutting Bandsaw Has Capacity of 60 x 60 in.

The X-60 is designed for cutting a wide variety of materials in operations where large capacity is needed with restricted length of cut, max length of which is 18 in. Frame columns are large box sections with replaceable guide rail. Cutting head is raised by two hydraulic cylinders, one at each side of the frame; this minimizes vibration and assures correct alignment.

Cutting head rolls on a heavy guide rail with ball bearing rollers. Variable speed drive, infinitely adjustable from 60 to 300 fpm, provides operator with exact speed for all materials. Desired speed can be dialed while machine is in operation. The 3000-lb unit is 103 in. side to side, 49 in. front to back, and 107 in. high. Blade length is 20 ft 10 in. x 1-1/4 in. x 0.035 in.

W F Wells & Sons, Three Rivers, Mich

MORE DATA? Circle 69, inside back cover



INDUCTION HEATING ASSEMBLY MACHINE automatically shrink-fits ring gears to flywheels at rate of 120 completed assemblies per hour—*Induction Heating Corp, 181 Wyth Ave, Brooklyn, NY*

MORE DATA? Circle 70, inside back cover

NOW! Adjustable magnification with any air-gage plug

MOORE

M/C

Comparator

Ask for a demonstration

—read your tightest tolerances over an 8 3/8" long scale

ILLUSTRATION APPROXIMATELY 3/5 SIZE

MOORE PRODUCTS CO.
H & Lycoming Sts., Philadelphia 24, Pa.

Offices: ATLANTA, BOSTON, CHARLOTTE, CHICAGO, CLEVELAND, DETROIT, HOUSTON, LOS ANGELES, LOUISVILLE, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH

In Canada: Moore Instrument Co., Ltd.—TORONTO *Branch:* MONTREAL

Ultrasonic Flaw Detector Uses Transistors, Printed Circuits

Type UI Reflectoscope is an ultrasonic unit making full use of transistors and printed circuits that can be used for both contact and immersed inspection.

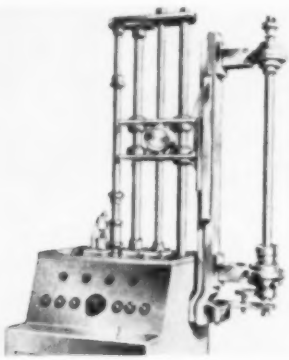
Features include a 12-in. dual trace display tube with a two-color display that enables flaw indications to be easily distinguished from range marks. There are four fast-acting flaw gates with separate channel indication.

Double slope distance amplitude correction controls compensate for near field effects and attenuation in the material. There are separate plug-in transistorized receivers for broadband operation with lithium sulphate or barium titanate transducers and also for operation with quartz transducers.

Frequency range is 1.0 to 25.0 mc. Repetition rate is variable from 200 to 2000 pps. It weighs 100 lbs, measures 18 x 14⅜ x 21.

Sperry Products Inc, Shelter Rock Rd, Danbury, Conn

MORE DATA? Circle 71, inside back cover



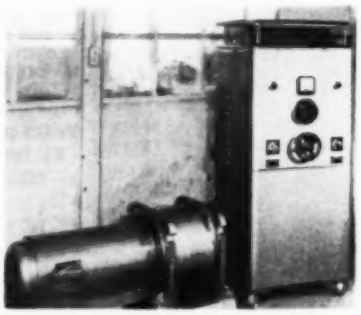
Floating Zone Scanning Unit Produces High-Purity Metals

Vertical floating zone scanner, using induction heating, produces metals of the highest purity, according to the manufacturer. The machine produces an extremely narrow molten zone which traverses the entire length of the vertically supported impure bar. The molten zone is maintained by a combination of electromagnetic forces, surface tension and hydrostatic pressure.

Model T-24 FZ will process bars up to 1¼ in. dia and 24 in. long. Scanning speed is continuously variable with an approximate range of 0-12 in. per hr. Return speed is continuously variable with a range of 40 to 800 in. per hr. The unit can be set to scan a certain length at a preset speed, then return at preset speed to the starting position and repeat the cycle.

Induction Heating Corp, 181 Wythe Ave, Brooklyn 11, NY

MORE DATA? Circle 72, inside back cover



High-Speed Die Sinking Performed By Two-Step Cutting Method

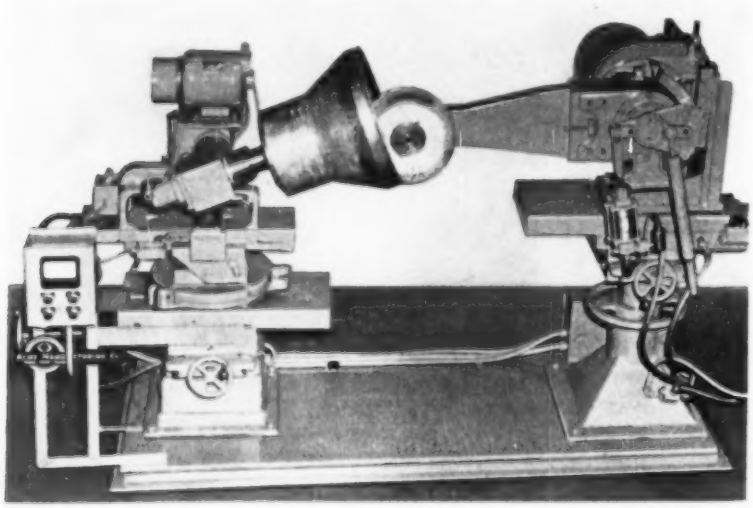
Rapid sinking of die cavities and odd-shaped holes in any metal is provided by a new two-step process consisting of (1) high-speed roughing with a spark-erosion machine tool using a newly-developed power supply called the Sparcatron R I G, and (2) finishing on the same machine, using its normal spark-cutting power supply to obtain final size and finish. Any precision spark-erosion machine may be used with an electrode of aluminum, Zamak alloy, copper, or brass made to the shape of the hole or cavity.

On the roughing cut, metal-removal rates of 6 cu in. per hr or more are said to be regularly obtained. Radiuses, fillets, and complex shapes are precisely reproduced with less than 1/32 in. left for finishing. At this high stock-removal rate the ratio of metal removal to electrode wear is 30:1 to 50:1 with aluminum electrodes, giving greater accuracy with fewer electrodes than previous methods.

The Sparcatron R I G consists of a rotary impulse generator and control cabinet. Four power settings are provided with a max output of 250 amps at 25 v. Power requirement is 12.3 kva, 220/440 v, 3-phase 60-c. No electronic maintenance is needed because no vacuum tubes are used.

Easco Products Inc, PO Box 587, Ypsilanti, Mich

MORE DATA? Circle 74, inside back cover

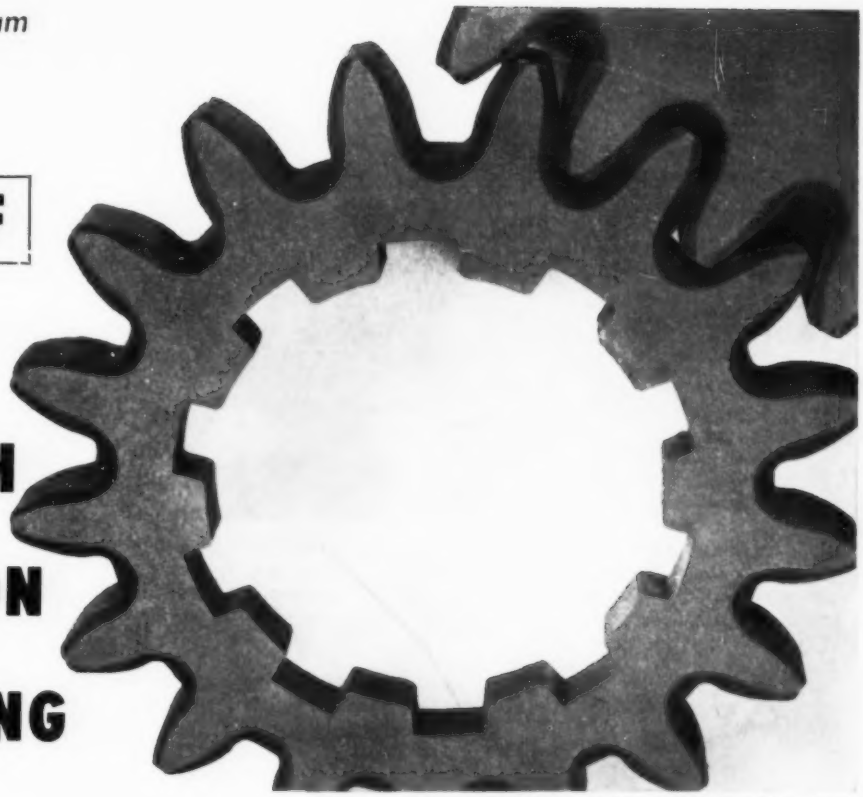


AUTOMATIC POLISHING MACHINE finishes a wide variety of shapes and sizes of reflectors and bowl shaped metal parts. It can handle parts made of aluminum-clad material, stainless steel, low-carbon steel, copper or brass—*Acme Mfg Co, 1400 E Nine Mile Rd, Detroit 20, Mich*

MORE DATA? Circle 73, inside back cover

at Farrel-Birmingham

NEW S & F TOOTH-TO-TOOTH INDUCTION HARDENING



Typical hardening pattern along flanks and through root.

...produces toughest gears yet!

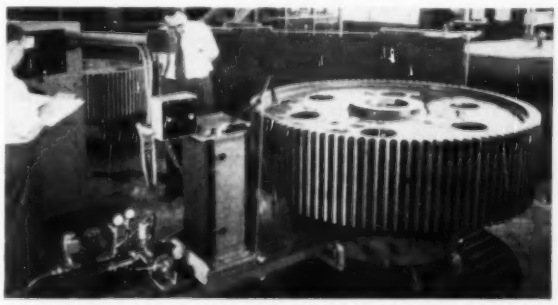
There's nothing like the S & F method of tooth-to-tooth gear hardening. Not only does it add amazing durability to big gears, but load-carrying capacity is vastly increased. Warpage can be insignificant depending on gear design. And there can be substantial savings in material and machining costs!

Farrel-Birmingham tells us that in one installation large gears with S & F induction-hardened teeth have already gone through over two years of rugged service with absolutely no sign of wear—whereas formerly, gears had to be *replaced* every two years. Reports of other installations are also highly satisfactory.

Precision controls maintain constantly accurate time, current, feed and distance between coil and workpiece to assure consistent results. In a group of similar gears, all portions of all teeth will have the same predetermined case contour and depth of hardness. In fact, hardening depth is so accurately controlled and warpage so minute that, for a number of gears, no additional machining is required.

S & F induction hardening units capable of handling gears from 3 in. to 20 ft. in diameter and larger, are available in semi-automatic and automatic models.

Want to know how this revolutionary approach to gear hardening can fit your production? Just ask us about it.

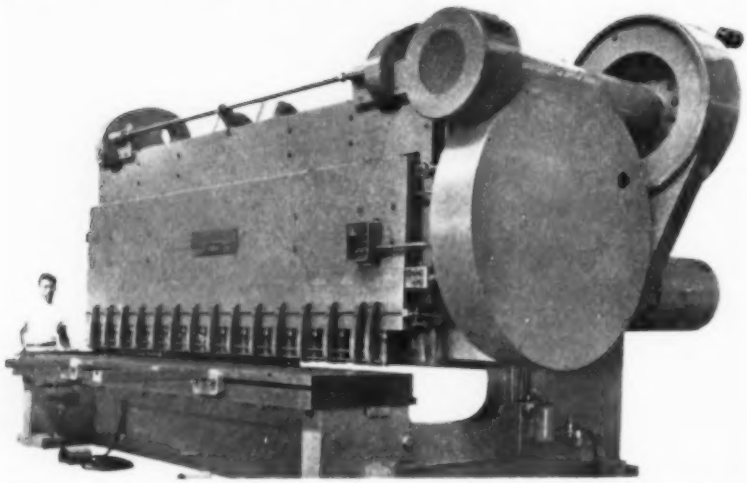


Spur, helical and double helical gears up to 157 in. diameter and 20 in. face widths are induction hardened tooth-by-tooth in this S & F equipment at Farrel-Birmingham, Ansonia, Conn.

KO CO., INC. PRECISION MACHINERY

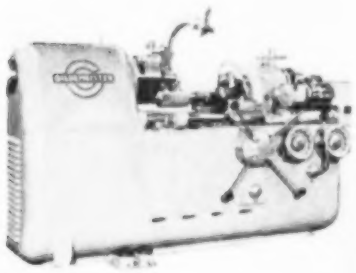
KURT ORBAN COMPANY, INC.

36 Exchange Place, Jersey City 2, New Jersey



ALL-STEEL SHEAR cuts 1¼ in. thick mild steel plate up to 14 ft long. It has hydraulic hold-downs, front-operated power back gage and forged alloy steel eccentric shaft—*Cincinnati Shaper Co, Box 111, Cincinnati 11, Ohio*

MORE DATA? Circle 75, inside back cover



German Lathe Equipped With 16-Station Drum Type Turret

Gildemeister RV 63 (German) is equipped with a 16-station drum type turret set on a horizontal axis with the tool axes parallel to the work axis.

It is said to be more precise than hex turret lathes because its long horizontal arbor absorbs the forces set up in longitudinal turning. Tooling is claimed to be less costly because the 16 stations can be used to divide complex operations into simpler operations requiring simpler tooling. Because of its position, the turret head can also be clamped more securely and accurately. Facing, recessing and cutting-off can be done without a cross-slide.

The lathe has a maximum swing of 27 1/16 in.; maximum distance between tool and chuck of 28 5/8 in.; speeds up to 2000 rpm, infinitely variable feeds to 0.031 ipm, and a 13.6-hp motor. It can be equipped with pre-programmed control of spindle speeds, direction of rotation, and longitudinal and rotational feeds. Price is approximately $15,000.

Dist by Carl Hirschmann Co, Inc, 30 Park Ave, Manhasset, NY

MORE DATA? Circle 76, inside back cover

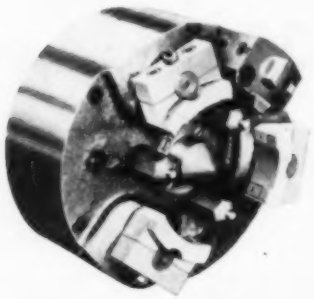
New Coiler Introduced With Flanging Attachment

Designed to perform flanging operations formerly done on a 500-ton press, the Curvit C-155, with special attachment, rolls 5/16 to ⅝-in. flanges in 30-in. OD stainless steel rings at rate of 90 per hr. Unit pictured is flanging stainless 2½ in. wide x 0.109 in. thick. Coiler can also be set up to simultaneously roll and flange in one operation. Attachment operates under pressure of 6000 psi at 80 psi air pressure. Drive die roller is reduction gear driven by a 5-hp electric brake motor.

Unit will coil pipe, tube, wire, strap flat stock, and solid bar stock up to 2½ in. OD. Coiling diameters are infiintely adjustable and are controlled by one adjustment. Setting up consists of installing die rollers, adjustment of air-operated radius feed, and setting the coiling pitch.

Maclodyne Corp, Curvit Div, 19 Grovesnor Ave, E Providence, RI

MORE DATA? Circle 77, inside back cover



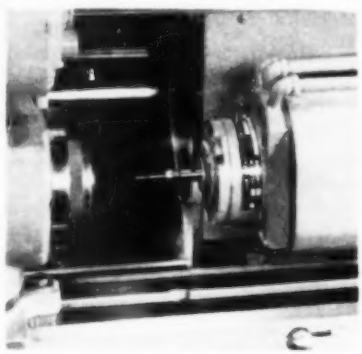
Power Chuck Uses Ball Joint Actuation Instead of T-Slots

Ball-Lok power chuck replaces conventional T-slot design with ball joint actuation, which is claimed to provide pull back action against fixed work stops.

Linkage ratio up to 5:1 is said to generate high gripping power with a minimum of friction loss. Jaw segments are reversible, interchangeable, and can be furnished with inserts. Chucks are available for internal or external applications in sizes of 10, 12, 15 and 18 in.

N A Woodworth Co, 1300 E Nine Mile Rd, Detroit 20, Mich

MORE DATA? Circle 78, inside back cover



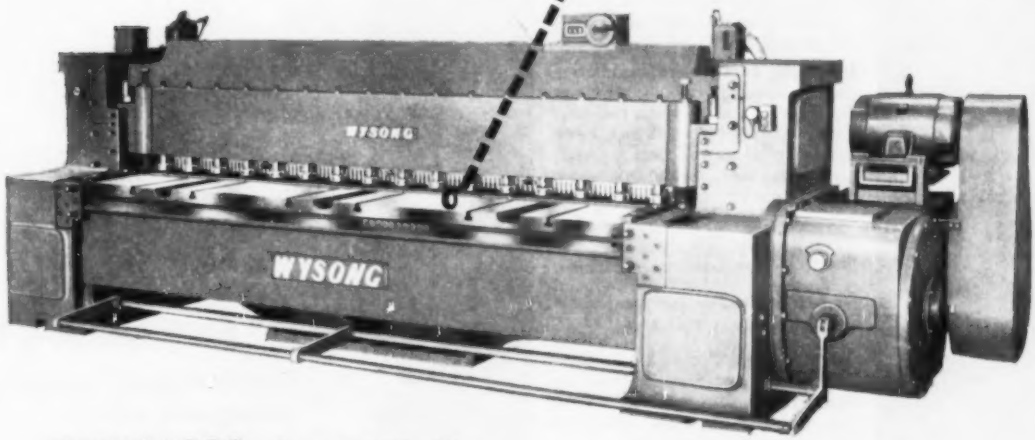
100,000 RPM SPINDLE for high frequency grinding grinds holes from 1/8 to 3 in. dia to tolerances of ±0.0004 in. Infeed is 0.0006 to 0.00001 in. It can be mounted on the Rivett Model 84 internal grinder—*Rivett Lathe and Grinder, Inc, Brighton 35, Boston, Mass*

MORE DATA? Circle 79, inside back cover

Want to bet a nickel?

It's a safe bet if your money is on a Wysong. Stand a nickel on its edge on the table of a Wysong shear and another nickel on the table of any competing shear of the same capacity. Start cutting full length on both shears and see how much longer it takes to topple the nickel on the Wysong.

Why? Wysong's compact construction, massive castings and low center of gravity assure less vibration, less deflection and greater rigidity. This is why Wysong shears maintain alignment for unsurpassed accuracy—year after year.



Model 1038 *Capacity 3/8" x 10'*

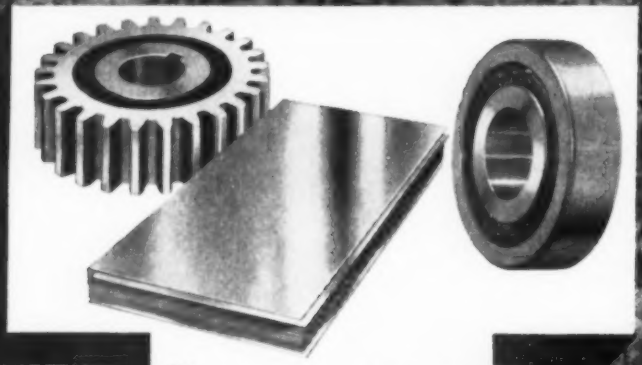
Other Wysong models have capacities from 16 ga. through 1/2" and cutting lengths from 24" through 12'. *You are not gambling when you:*

"Buy a WYSONG .... It's MILES ahead"

WYSONG

WYSONG & MILES COMPANY
615 Fulton Street
Greensboro, N. C.

VALVOLINE
Tectyl
protects metals against RUST



VALVOLINE's amazing Tectyl rust preventives protect metal surfaces against *every kind of rust and corrosion* during storage and shipping.

Low-cost Tectyl compounds are easy to apply by brush, spray or dip and just as easy to remove. They protect metal surfaces against . . . sun and rain . . . heat and cold . . . salt air and salt water . . . humidity, perspiration and corrosive fumes.

Tectyl rust preventives meet exacting government specifications.

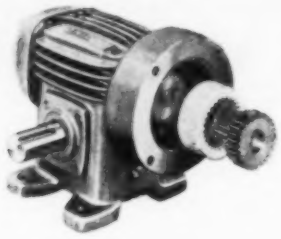
Write today for these two helpful Tectyl charts

1. "Valvoline Tectyl U. S. Government Approved Packaging and Preservative Chart." Gives the Army, Navy and Air Force "Specs" and applications.

2. "Valvoline Tectyl Industrial Rust Preventive Comparison Chart." Specifies applications covering the entire field.

VALVOLINE Tectyl ALL-METAL PROTECTION RUST PREVENTIVES

VALVOLINE OIL COMPANY, Freedom, Pennsylvania
Division of Ashland Oil & Refining Company



Speed Reducer Line Offered With C Flange Motor Mountings

Hi-Line series of fin and fan cooled units is available with either of two types of C flanges. One style permits direct connection of the motor shaft to the reducer's input shaft; other style is equipped with a bell shaped flange which allows sufficient room to take a flexible motor coupling between the drive motor and the input shaft of the reducer. Designed to fit standard NEMA frames, the flanges are ready for installation of the drive motor.

Units are available in a complete range of sizes from 1.33 to 5.25-in. center distance. Horsepower ratings are from 1/16 to 18.

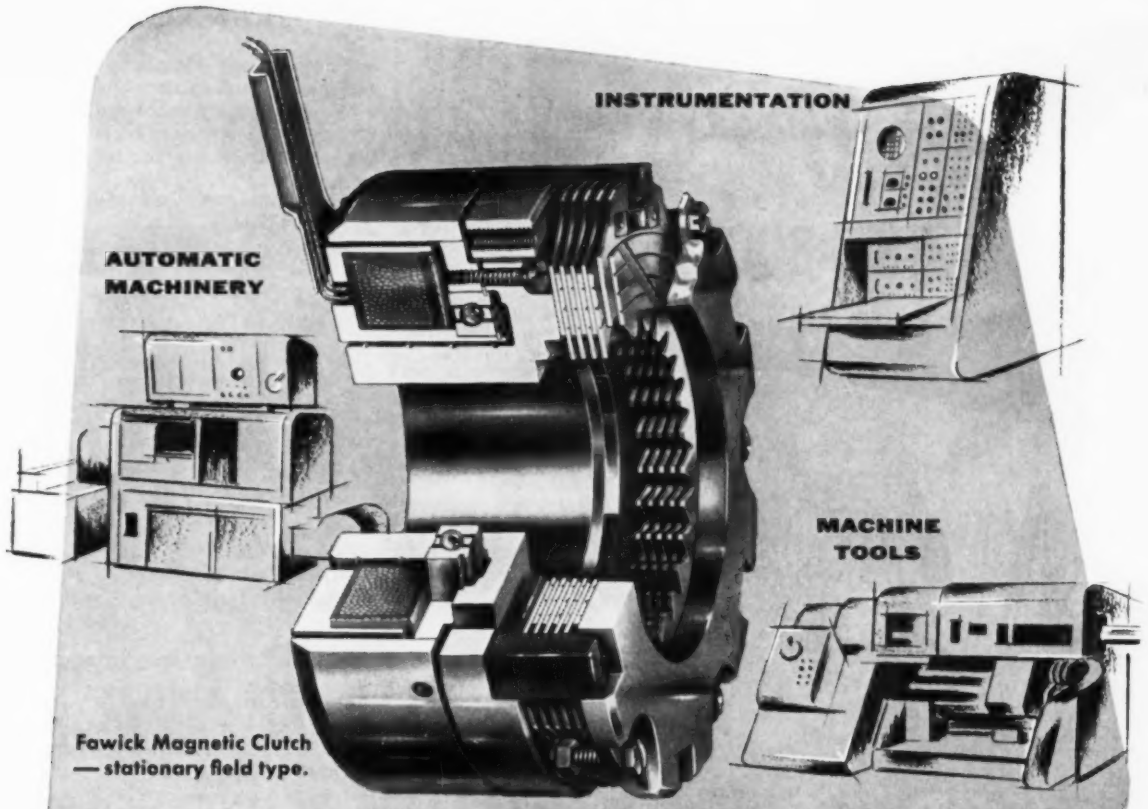
Ohio Gear Co., 1400 E 179th St., Cleveland 10, Ohio

MORE DATA? Circle 85, inside back cover

Compact Magnetic Separator Introduced by Techline

Model 3550 separates ferrous parts from media and is designed for applications where size of part, or holes and recessed areas in it, make impossible the selection of media that would permit mechanical separation.

Parts and media are carried on a conveyor belt which passes under a cleated, parts-conveyor belt. A permanent magnetic plate located above the parts belt lifts parts from media. They are discharged into a media pan or tote box when they reach the end of the magnets. Non-magnetic media remain on the conveyor belt



FAWICK MAGNETIC CLUTCHES

open up new design possibilities

Forward-thinking designers can provide advanced clutch-and-brake performance for their products-of-tomorrow by using FAWICK Magnetics. These electric clutches and brakes offer unmatched advantages for modern high-speed, stop-and-start machinery.

optimum controllability—accurate response to controls with full power transmitted instantaneously. Controls can be local or remote, manual or automatic (push button, relay or limit switch).

trigger-quick action—elimination of residual magnetic drag, and minimum "decay time" assure fast acceleration and high cyclic rates. Engagement is smooth and shock-free. No axial thrust.

space-saving design—compact envelope fits limited space requirements. Self-contained clutches feature largest bore with shortest axial length.

life-time dependability—extra-long life in wet or dry operation assured by excellent heat dissipation, careful material selection and precision production.

FAWICK Magnetic Clutches and Brakes are available in sizes from 2 to 13 inches diameter with torque ratings from 36 to 48,000 in.-lbs. Write for Bulletin M-101 or contact your nearest FAWICK representative.

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HANDY ELGIN TOOL GUIDE
of Solid Carbide Rotary Tools gives a wealth of useful facts you'll want to keep at your fingertips. It illustrates Elgin's complete line—End Mills, Internal Grinding Tools, Drills, Tool Sets, Reamers, Boring Tools, and Burs—gives handy ordering data and charts showing recommended feeds, speeds, and formulas you'll find useful on the job. Elgin "Golden Circle" Tools are machine-ground of the finest carbide with exceptionally sharp, smooth cutting edges that assure positive uniformity, longer tool life, longer runs, higher production, lower costs. They'll really stretch your production tool dollar!

Get your copy of this valuable, fact-packed tool guide.

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Abrasives Division
ELGIN NATIONAL WATCH COMPANY
ELGIN, ILLINOIS

and are dumped into a separate pan. Optional demagnetizer can be mounted in the discharge chute to process any part that may have become magnetized inductively. One motor drives both belts.

Wheelabrator Corp, Techline Div, Ave V, Vicksburg, Mich

MORE DATA? Circle 86, inside back cover

Fractional Dimension Boring Tools Reduce Setup Time

Drop forged straight shank boring tools in fractional dimensions are designed to reduce setup time and are adjustable to eliminate overhang.

For lathe boring they are available in three sets: No. 1 for 6 to 10 in. lathes in 4 divisions of 3/16 to 7/16 in. with a 3¼ in. long shank. No. 2 for 12 to 16 in. lathes in 6 divisions of 3/16 to ½ in. with a 5 in long shank. No. 3 for 18 to 24 in. lathes in 6 divisions of ¼ to ⅝ in. with a 6 in. long shank.

Illustrated is the jig boring set for use with spring collets in dia of ½ and ⅝ in. OD. The tool is adjusted to the required length.

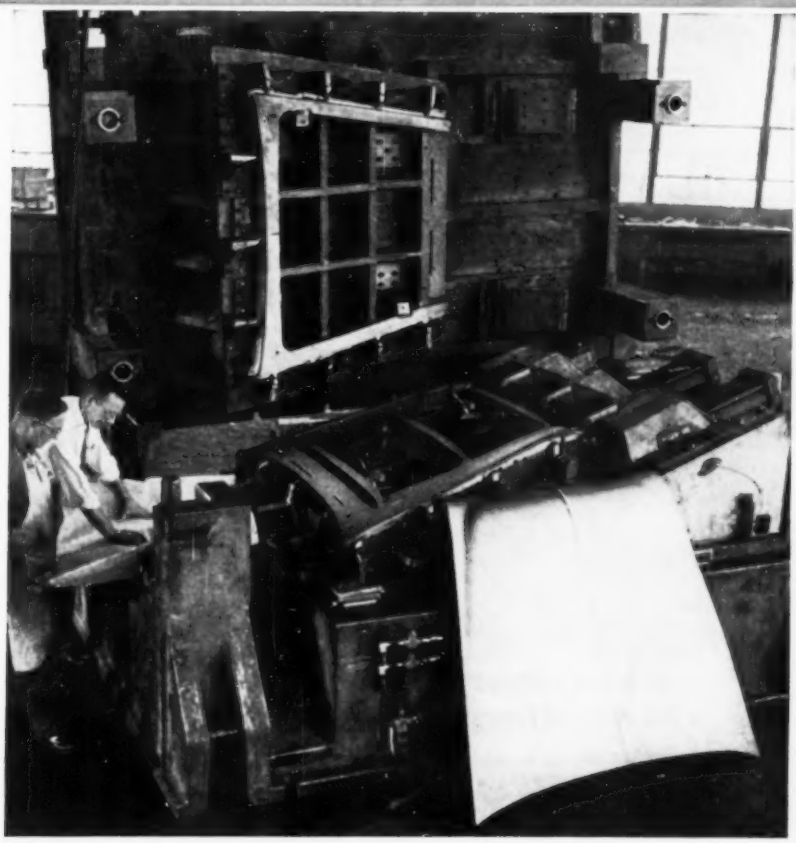
N C Thomson Co, 10455 Pinecrest Dr, Ferndale 20, Mich

MORE DATA? Circle 87, inside back cover

"Personally I'd tire of Pizza every day."

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributors: Bethlehem Steel Export Corporation



Automotive Die, in 101 Sections, Made from Water-Hardening Steel

This huge die, made up of Bethlehem W-1 carbon water-hardening tool steel, trims an automobile hood. Made from tool steel furnished by Peninsular Steel Co., Detroit, the die was photographed recently at Republic Die & Tool Company, Wayne, Mich. It contains 44 composite sections, 34 wear plates, and 23 solid sections.

Bethlehem carbon water-hardening steels were selected for this exacting application because of their good wear-resistance, easy machinability, and simple heat-treatment—plus ease of welding should repair become necessary.

Bethlehem carbon water-hardening tool steels, because of their carefully controlled hardenability, provide economical service in applications calling for high shock-resistance. And with their highly selective carbon range, they have good resistance to wear, plus the toughness to withstand cold battering.

If you have any questions about the use of Bethlehem carbon water-hardening tool steel, or any of our other popular grades, get in touch with your Bethlehem tool steel distributor. He's as near as your telephone.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Here's How to Stabilize Gages

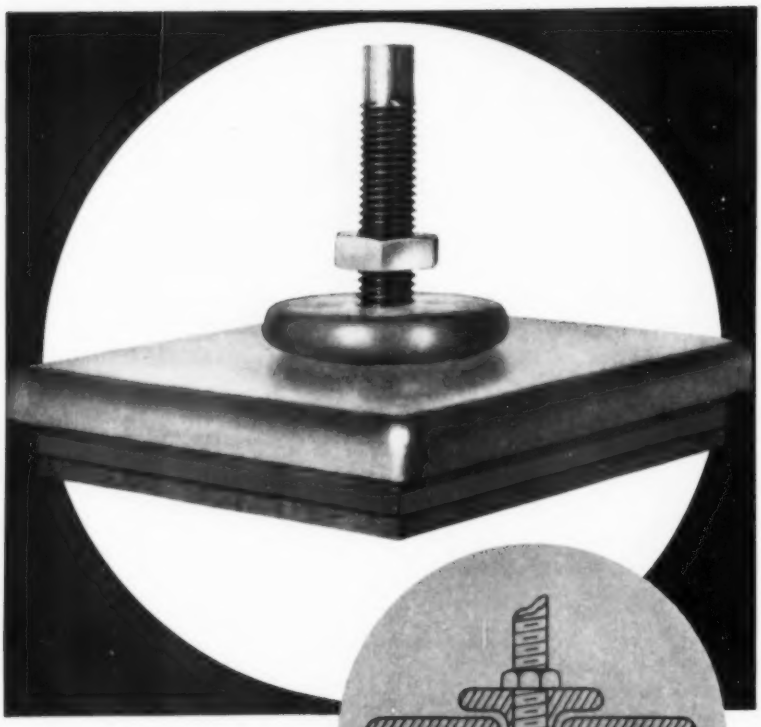
High-precision gages, commonly made of BTR tool steel (AISI Type 01), need a stabilization treatment if they are to maintain their accuracy for years. Otherwise expansion will eventually change dimensions outside of the permissible tolerance. These dimensional changes are in a magnitude of hundred-thousandths of an inch per inch, or smaller. Insignificant on ordinary tooling, they are important on precision gages.

The expansion which occurs over a period of time is due to the transformation of austenite retained during the quench for hardening. The object of the stabilization treatments is to transform the retained austenite during the treatment, so that none remains which could transform later on. This condition exists in all tool steel grades which can be hardened to Rockwell C 60 or higher.

The most common method for stabilizing high-precision BTR gages is: 1. Quench and temper in the normal manner to produce the desired hardness. 2. Rough grind. 3. Subzero cool to minus 100/120 F in refrigerator or dry ice. 4. Warm to room temperature and then retemper at original temperature. 5. Finish grind to size. 6. Repeat cycles of subzero cool followed by tempering five more times. 7. Lap or superfinish to size.

Sometimes it is possible to shorten this procedure, particularly if the design is such that there is little hazard of cracking. For example, the tools can be subzero cooled directly from the quench, with no interval at room temperature, followed by tempering and grinding. This will permit stabilization with only two additional cycles of subzero cool plus temper, but the disadvantage is that cracking may occur after quenching.

It is also possible to shorten the stabilization by cooling to minus 314 F in liquid air. This permits reducing the cycles of subzero cool plus temper to three instead of six.



UNISORB LEVEL-RITE Machinery Mounting

The new Level-Rite has been developed as a universal self-contained leveling mount for all types of machinery. It combines the features of Unisorb with the advantages of a rugged, easy-to-use device for precise leveling of machines. Machines are completely "mobilized." One unit required for each machine leg, with load ratings to 7500 lbs. per unit.

Exclusive Screw-Post Design . . . Machine legs mounted on special leveling screw and plate assembly, which rests in all-steel base plate. Machine is quickly and easily leveled by simply rotating the square top of the leveling screw, then securing lock nut. Machines stay level.

No bolts, lag screws or cement . . . Level-Rite eliminates all need for anchor bolts or screws. Designed so compression provides positive hold, no "walking" or creeping under the toughest side loads. Machines can be moved whenever and wherever required.

Superior Unisorb Vibration Dampener . . . Industry's most efficient isolator reduces transmitted vibration up to 85%. Contributes to more productive machine hours, lower building maintenance, higher machine speeds. Unisorb will not deteriorate, is resilient, and is impervious to cutting fluids and cleaning compounds.

UNISORB 200 SOUTH STREET BOSTON 11, MASS.

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Position .....
Company .....
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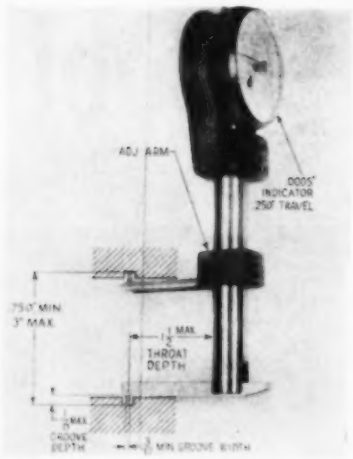
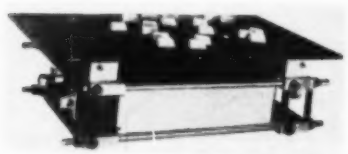


Portable Dial Indicating Gage Checks Internal Grooves

Boice Groove Gage, with 0.0005-in. indicator, has 2¼ in. of diameter range adjustment and is recommended for short-run parts inspection. Instrument that can be handled by skilled or unskilled personnel is suited for patrol inspection, at-the-machine checking or, with comparator stand, it may be employed for bench inspection. Design variations may be adapted for solving unusual or intricate internal groove gaging problems.

Boice Gages Inc, Hyde Park, NY

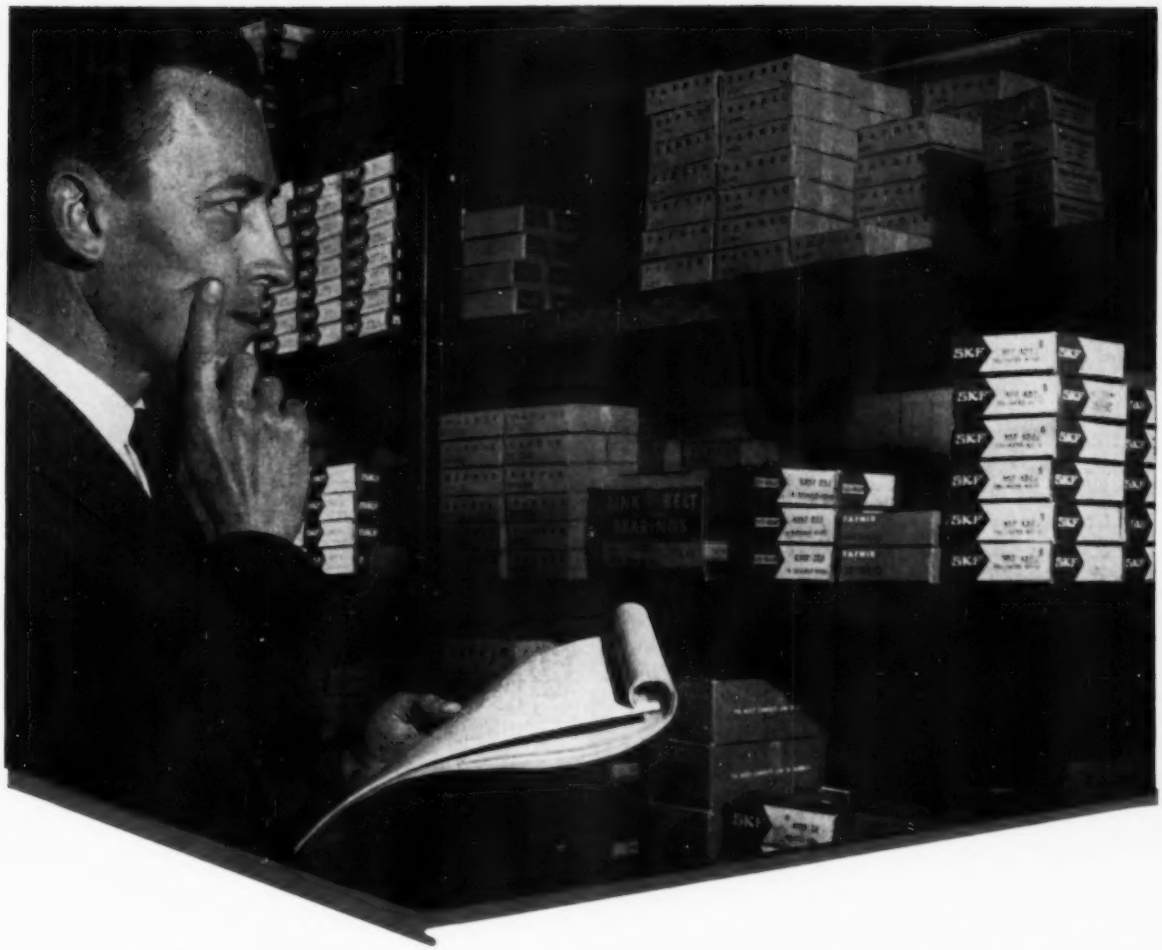
MORE DATA? Circle 88, inside back cover



Furnace Control Unit Provides Independent Control of Elements

Multi-circuit Auto-transformer is an adjustable voltage system which provides independent control of each heating element in silicon carbide electric furnaces and kilns. Units, with 10-kw power control system, incorporates separate controls for 18 silicon carbide elements, providing them with voltages from zero to 120 v in 60 equal steps.

System offers varying voltage control to match perfectly the varying resistance of the individual heating element. In addition, the separate controls make it possible to vary the voltage to each of the elements and provide desired temperatures in any area of the heating chamber. Elements need not be matched, or entire sets changed when one is re-



Bearings, Inc. customers don't worry about inventory control . . .

They let us keep *their* worries in *our* stockroom. We make surveys of the immediate, as well as long range requirements for all bearings in their equipment. Those carried in their stock are fast-moving. Expensive precision bearings, specials and other bearings purchased infrequently are carried in the Bearings, Inc. branch — ready for instant delivery, day or night.

If a shortage develops or production is interrupted, our customers know the bearings they need are in our stocks. A phone call and the bearings required will be on the way. Our customers know the value of this important service.

If bearing inventories are worrying *you*, why not call the Bearings, Inc. branch nearest you for help.

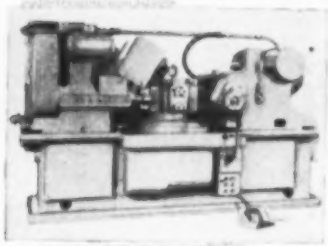
Providing bearing service in the North ➤ **BEARINGS, INC.**

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Painesville • Toledo • Youngstown Zanesville • **INDIANA:** Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York **WEST VIRGINIA:** Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden **NEW YORK:** Bolanrol Corp., Buffalo • Niagara Falls • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and in the South ➤ **DIXIE BEARINGS, INC.**

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans **N. CAROLINA:** Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville **VIRGINIA:** Richmond

GOSS and DE LEEUW
AUTOMATIC CHUCKING MACHINE



means a complete piece... at each index cycle

When a piece is finished it is *completely* finished without the necessity of a second operation. Furthermore, it means *more* finished pieces in a given period of time and greater accuracy in *every* finished piece.

The "1-2-3" Method is exclusive with Goss & DeLeeuw. With it, three ends of a piece can be machined at a single chucking of the work, simultaneously or in sequence depending on the operations involved. It will pay you to investigate.

Send for illustrated literature giving detailed information. Send samples and ask us to give you cost estimates of handling this work on a "1-2-3" Goss & DeLeeuw Automatic Chucking Machine.

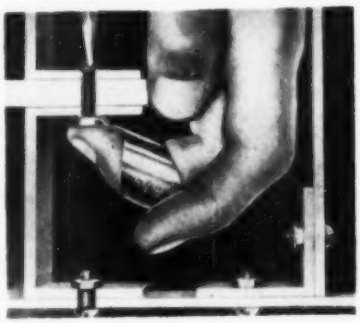
GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

GOSS & DeLEEUW — QUALITY PRODUCT-QUANTITY PRODUCTION

placed due to breakage or high resistance.

Ariel Davis Mfg Co, 3687 S State St, Salt Lake City, Utah

MORE DATA? Circle 89, inside back cover



FINGER WRENCH called Touch 'n Hold enables user to reach into snug, narrow, remote, or hidden working areas to hold a nut or bolt in true fixed position for assembly or disassembly. Adjustable-to-fit tool, worn like a ring, is supplied in popular hex head nut sizes—*Beaver Tool Co, PO Box 256, Huntington Station, NY*

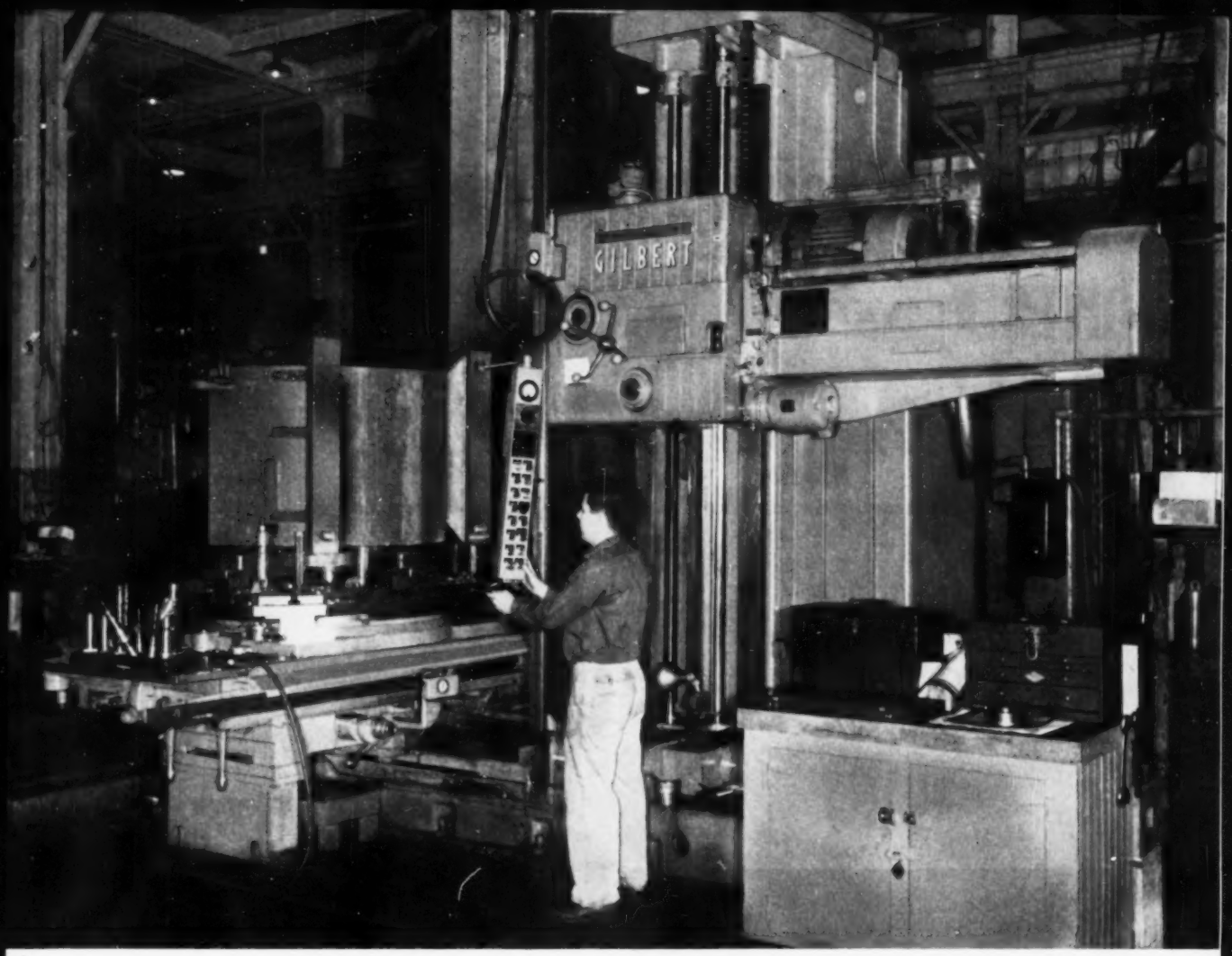
MORE DATA? Circle 90, inside back cover

Tracer toolholders that fit almost all tracer lathes use an elongated 55° diamond disposable insert that resists pullout even when facing or machining a shoulder. Insert has a larger surface area for more solid clamping action and better heat dissipation. Toolholders are available in a complete selection of sizes and styles.

Metallurgical Products Dept, General Electric Co, Detroit 32, Mich

MORE DATA? Circle 91, inside back cover

"But I made it exactly like the drawing."



Courtesy The Reliance Electric and Engineering Co.

5" Gilbert cuts setup time 20%, operating time 20% for Reliance

"This 5" Gilbert is saving us approximately 20% on setup and 20% on operating time on motor frames," reports W. R. Henninge, Methods Engineer at The Reliance Electric and Engineering Co., Cleveland.

But those are only part of the savings earned by this versatile machine. On some close tolerance jobs, such as rockers, Reliance either had to make jigs costing $500 and more, or send each part to their tool room to be run on a jig borer.

Now, by making a very simple locating fixture, and using the Gilbert's automatic positioning, they have cut the job in half. At the same time, they have eliminated scrap and improved accuracy for assembling.

Wouldn't savings like that be important to your company? Your nearby Cincinnati Gilbert representative can show you how to get them.

The Cincinnati Gilbert Machine Tool Co., 3340 Beekman St., Cincinnati 23, Ohio

Ask for new catalog

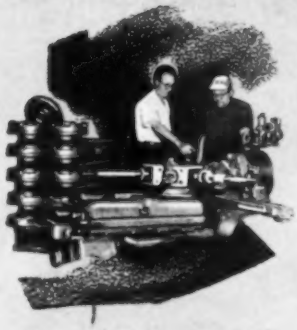
GILBERT

CIRCLE 246 READER SERVICE CARD

SWITCHING TO ADAMAS CARBIDE GRADE 548 GIVES OLIVER 170 MORE PIECES PER INSERT

-cuts downtime by 75%

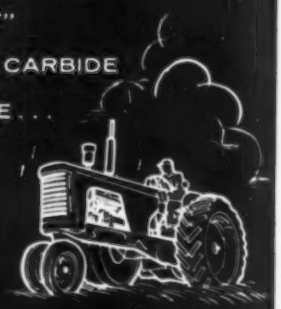
Oliver Corporation—never satisfied until they are sure they have the best—wanted greater production, per carbide cutting edge, in machining front tractor wheels. Shown discussing the problem are Lyle Bushbaum, Divisional Foreman; A. G. Obermeier, Shop Supt.; of Oliver's Charles City, Iowa plant; and Adamas Service Engr., Walter Sukiennik.

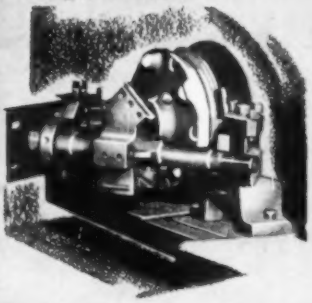


The machines in use are P & J automatic turret lathes. Using brazed tools on the hard cast iron parts, production never exceeded 50 pcs. per sharpening. Mr. Bushbaum, examining the operation, considered using throwaway inserts but questioned their ability to stand up under the heavy shock conditions.

OLIVER CORPORATION
"NEVER SATISFIED UNTIL
IT HAS THE BEST"
BUYS TUNGSTEN CARBIDE
ON PERFORMANCE...
NOT HABIT!

If you are interested in improved efficiency, economy, quality — let's hear from you . . . the coupon is for your convenience.





It was finally decided to set up the lathes with Adamas' Dex-A-Tools and Grade 548 throwaway inserts. This combination proved to be very rugged, and efficiently handled the operations involving a series of interrupted cuts of 3/16" in depth, with a .017 feed at 340 sfpm.

The change to Adamas' Dex-A-Tools and Grade 548 enables Oliver to step up production to 480 pieces per carbide insert and drastically reduce downtime. This is in sharp contrast to the previous output of 50 pcs. per sharpening with a well known competitive grade. Production per corner now averages 80-100 pcs.

Producers of
Tungsten Carbide Tools,
Tool Tips,
Dies, Wear Parts
Dex-A-Tool

ADAMAS CARBIDE CORPORATION
KENILWORTH, NEW JERSEY

☐ Please send new Adamas Catalog No. 359 ☐ Please have an Adamas representative call ☐ Please send new Adamas Carb-A-Guide Selector

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2112

FIELD REPORT...

NTDMA's new officers...

National Tool & Die Manufacturers Association elected new officers at its 14th annual convention held in New York this month. Appointed to serve during 1959-60 are (left to right) Harold G. Murdock, vice president of Arrowsmith Tool & Die Corp, Los Angeles, first vice president; E W Barnwell, president of Apex Corp, Roseville, Mich, treasurer; John A Barth, vice president and general manager of the Barth Corp, Cleveland, president; John D Dewhurst, president of Arrow Tool Co, Wethersfield, Conn, secretary; and James A Perdy, vice president of Atlantic Manufacturing Co, Philadelphia, second vice president

Bell & Howell Talks Merger With Consolidated Electrodynamics

Proposal to merge Consolidated Electrodynamics Corp, Pasadena manufacturer of electronic and instrumentation equipment, with Bell & Howell Co, Chicago photographic equipment firm, has been approved in principle by directors of both companies. Detailed merger agreement will be drawn up and submitted to directors and shareholders of both concerns for approval.

Bell & Howell, which employs 4000, had sales of $59 million last year. CEC, which would function as a separate organization, has a payroll of 3000; sales last year were $32 million.

Sperry Products Taken Over

Sperry Products Inc, Danbury, Conn, manufacturer of ultrasonic testing equipment, has been acquired by Howe Sound Co, New York City concern with mining and manufacturing interests that include aluminum building products, precision castings, copper, brass, and bronze strip casting, and textile machinery.

Sheffield Has R&D Contract To Study Vibration Grinding

Sheffield Corp, Dayton, has a research and development contract from the Air Force to evaluate the use of high-frequency vibrations, such as those used in the ultrasonic range, with conventional grinding machines and techniques in order to meet future requirements for grinding high strength thermal resistant alloys for aircraft and missiles. Basic research on the effects of high-frequency devices capable of producing 20,000 or more vibrations per second will be done on representative types of grinding machines.

British Ford Motor Co ...

... has completed a $210 million expansion program and expects to spend another $140 million over the next few years. First phase, begun five years ago, has upped daily production of vehicles (cars, tractors, trucks) from 1220 to 2000 and output is still increasing. Expansion includes new $20 million foundry; $28 million paint, trim, and assembly plant; and a $16.8 million body stamping facility. Second program is reported to include plans for production of a new baby car.

Aerojet-General Corp's ...

... solid rocket plant at Sacramento, Calif, has an $8 million contract from Grumman Aircraft Engineering Corp for development of a high-performance rocket power plant for the Navy's newest air-to-air guided missile, the Eagle. Propulsion system is already well under development since Aerojet began work on the program some months ago in anticipation of the order.

Sikorsky Gets $23 Million Order

Sikorsky Aircraft, Stratford, Conn, division of United Aircraft Corp, has a Navy contract for production of S-58 helicopters. Deliveries are scheduled during 1960 and 1961.

Minneapolis-Honeywell ...

... is building a million-dollar research center and transistor plant at Riviera Beach, Fla. The 40,000 sq-ft facility will employ 900.

Russia Enters Competition for Canadian Small Car Market

A blue and white Moscow-built Moskvich 407 is being displayed to dealers and the public at the Modern Import & Export Ltd showroom in Toronto. Firm was approached by the Russians and agreed to test the market with one car. The Canadian company, which hopes to import the cars on a large scale, reports that many dealers had turned down the offer because they feared Canadians would not buy a Communist-built auto.

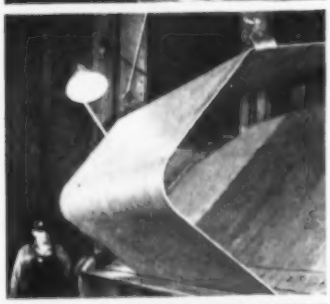
About 30% of the 60,000 Moskvichs made each year are earmarked for export. The four-door sedan, priced at about $1500, has swing-back front seats which convert into

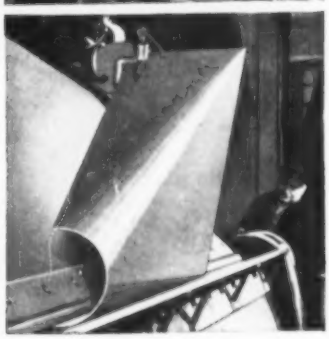
Bending Steel Plates for WELDMENTS?

do it economically with

CHICAGO® POWER BENDING BRAKE

(no dies needed)



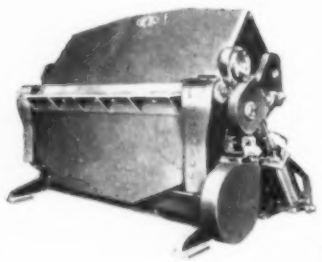


The accompanying illustrations give an idea of the versatility of the CHICAGO bending brake. No dies have to be changed or adjusted—no dies are used on these jobs. Yet, duplication is easily obtained on successive pieces. The machine is quickly adjustable for different thicknesses of material up to rated capacity. Automatic stop regulates the angle of bend. This, too, is adjustable to any degree of bend. The ease of changing from one job to another and the elimination of die costs make the CHICAGO bending brake the economical method for bending steel plates for weldments.

Many standard sizes are available with capacities for bending mild steel up to 12 feet by ¼ inch or 16 feet by ½ inch. Also many standard sizes in hand and power operated models for sheet metal.

BULLETIN P-55
This bulletin gives the details of how these and many other jobs are handled. Also complete description of the machine and specifications of the standard sizes.
Ask for a copy.

Front view of one of the heavy duty models of CHICAGO power bending brake showing the operation end of the machine.



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Recommendations for any job on request.

CHICAGO DREIS & KRUMP

Press Brakes • Straight-Side Presses • Press Brake Dies
Hand and Power Brakes • Special Metal-Forming Machines

DREIS & KRUMP
MANUFACTURING CO.

7434 South Loomis Boulevard, Chicago 36, Illinois

Field Report . . .

beds. A four-stroke, four-cylinder, water-cooled engine can produce 45 hp and a top speed of 69 mph. It gets about 30 miles to the gallon.

Acoustica Diversifying

Acoustica Associates of Plainview, NY, is negotiating for acquisition of Ender Monarch Corp, Garfield, NJ, through exchange of stock. Acoustica makes ultrasonic equipment for industrial cleaning and processing, and ultrasonic systems for missiles and other military uses. Ender produces fluorescent light fixtures.

Controls Co of America . . .

. . . Schiller Park, Ill, manufacturer of control systems for aircraft, missiles, computers, electronic, and appliance industries, has entered the semi-conductor field with formation of a new subsidiary, Solid State Electronic Controls Inc, with plant and headquarters to be located at Tempe, near Phoenix, Ariz. Facilities will include research and development labs and production equipment for the growing of crystals and the manufacture of semiconductor products.

Telecomputing Corp Busy

Telecomputing Corp of Los Angeles has bought Monrovia Aviation Co, a subsidiary of Carrier Corp. Company manufactures aircraft subassemblies and ground support equipment. Annual sales volume is in excess of $5 million, current backlog is more than $4 million.

And Telecomputing has new contracts totaling $1.6 million from Western Electric Co for production of gyro systems for the Nike-Hercules ground-to-air missile.

(continued on p 148)

"Did you post the speed-up notice in the spray department?"

BATH Tap'n Gage TIMES

A series of technical discussions that will be helpful in getting better results from tapping and gaging operations

Vol. 1 No. 11

Subject: Facts About Thread Gages:

Plug and Ring Thread Gages are used to control the limits of the majority of threaded products manufactured. The economic value of this output alone suggests that users should demand the finest quality gages obtainable. Less than the best can result in passing parts that should be rejected and rejecting parts that should be passed.

There are ways for the user to determine if gages meet the highest standards of quality. They can be grouped into two categories as follows:

1. Inspect, check and test all gages within the capabilities of your own facility.
2. Insure quality beyond that revealed by your inspection and testing by knowing the integrity and proficiency of your gage suppliers.

Normal Thread Elements:

Most users do not check thread elements beyond accepted commercial standards. One or more of the following elements are usually inspected: major diameter, pitch diameter, minor diameter, lead and thread half-angle.

Commercial and military specifications set definite allowable deviations for these elements but a quality gage has minimum variation assuring the user of the maximum product tolerance range.

Hidden Thread Elements:

These elements have been understood and controlled for a relatively short time even by quality gage manufacturers. The problem is twofold, being one of detecting error through advanced measuring technics and eliminating error through refined manufacturing procedures.

1. **Helical deviation** (drunken helix)
   This is helix deviation from the true helical path. On a plug thread gage this means that the helix does not advance at a uniform rate. It is unlikely that this condition will be detected by conventional lead checking equipment. The result is an increase in the effective pitch diameter. A "Go" plug would then reject work which should pass and a "Not Go" plug pass work which should be rejected.
2. **Thick end thread**
   This term is applied to end threads if they have a thickness at the pitch diameter greater than one-half the pitch. A "ground only" or "stick lapped" gage is likely to have this error while a quality ground and "ring lapped" gage will not. Effective pitch diameter is again increased.
3. **Surface finish**
   The degree of surface finish on thread flanks has a definite bearing on wear life. Ordnance requirements specify a finish of 8 RMS maximum. This accuracy can only be achieved by "ring lapping" plugs and lapping rings with adjustable or progressive laps.
4. **Minor diameter eccentricity of thread ring gages**
   Quality gages have concentricity of pitch and minor diameters such that the calculated minimum effective minor diameter is not less than the basic minor diameter minus two times the sum of the gage makers tolerance for pitch and minor diameters. It is difficult to manufacture small sizes within these limits and the measuring problem is such that the user must rely in most cases on the reputation of the gage maker.

Metallurgical Factors:

Close dimensional control of gages is put to practical use through wear life and stability. Quality gages are made of high speed steel or graphitic steel depending on size and style. Surface treatments and precision chrome plating are available for certain abrasive conditions. Hardness and toughness should be assured by the removal of amorphous skin.

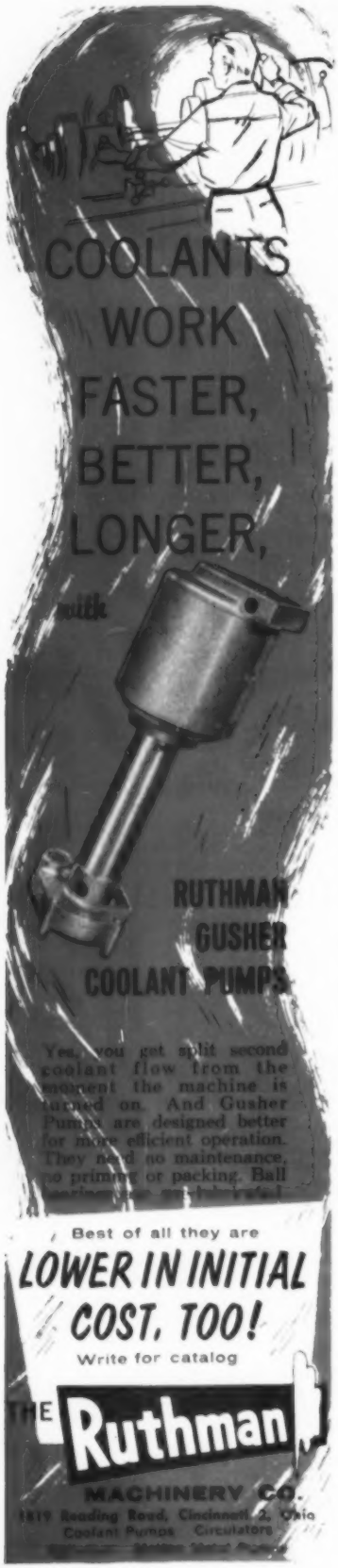
Summary:

What then are the ways for the user to evaluate the quality of gages and gage suppliers?

1. Become proficient in checking the normal thread elements and determining to what extent allowable deviations are used by the supplier.
2. Be aware of the "hidden" thread elements and inspect for as many as possible. Make certain that the supplier knows of these elements and considers them in the manufacturing process.
3. Be sure that the supplier has control in his own plant of the manufacturing process from raw stock to finished product. This should include metallurgical facilities and equipment for precision chrome plating.
4. Benefit from the experience of the supplier personnel. Do they serve on ASA and governmental gage committees? Are they the leaders or the followers?

Experienced Bath engineers will be glad to assist you with any of your gage problems!

● Cylindrical and Thread Gages ● Ground Thread Taps ● Internal Micrometers John BATH & Co., Inc.
22 Mann Street, Worcester, Mass.



Field Report . . .

Pacific Extrusions Inc . . .

. . . has opened the first extrusion aluminum facility in northern California. The new concern, an affiliate of Aluminum Extrusions, Charlotte, Mich, has production operations underway in a 20,000 sq-ft plant in Watsonville. In addition to its own die shop, plant has equipment to permit heat treatment of T5 and T6 temper aluminum and will include facilities for buffing. Anodizing equipment will be installed soon.

Perkin-Elmer's R&D Facility

Perkin-Elmer Corp of Norwalk, Conn, has opened a 15,000 sq-ft research and development facility in Los Angeles. Company is engaged in manufacture of precision optics, electronic digital circuits, computers, and systems. Initial plans call for a staff of 100 scientists, engineers, and other personnel within a year.

Tenney Building Southern Plant

Tenney Engineering Inc, Union, NJ, producer of environmental test chambers and heat transfer components, is putting up a plant on an 11-acre tract in Wilmington, NC. Plant, land, and equipment for the facility will cost about $1 million. Production of refrigerator coils in the 75,000 sq-ft building will start next month.

Proctor & Schwartz . . .

. . . Philadelphia manufacturer of machinery for the textile, tobacco and process industries, is building an 80,000 sq-ft plant at Lexington, NC; initial employment will be approximately 100. P&S is the parent company of Proctor Electric Co which has an appliance plant at Mt Airy, NC.

American Metal Climax

. . . is building a new germanium refining plant at Carteret, NJ. Facility will be equipped to produce germanium dioxide from both primary raw materials and scrap. In addition, it will have equipment for production of germanium metal designed to meet the needs of the electronics industry.

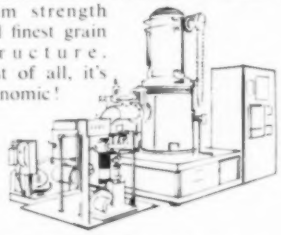
Circular Tool Co . . .

. . . Providence, RI, has expanded sales distribution of its circular cutting tools which include Circle R slitters (specialized tools developed to do specific jobs) and saws for cut-

HOWARD GILBERT, Hayes Asst. Sales Mgr., tells about the . . .

"VACUUM AGE" OF HEAT TREATING

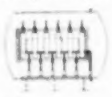
A major New York manufacturer of aircraft equipment recently reported their Hayes Vacu-Master Cold Wall Furnace was paying off in many ways — providing rapid cycling, simplified work handling, and complete production flexibility. Additionally, the vacuum furnace has eliminated need for atmosphere equipment . . . and produced work (stainless steel brazing) of maximum strength and finest grain structure. Best of all, it's economic!



Similar Success Stories come to us from other users of Hayes Furnaces. Successful heat treating of "exotic" metals (tantalum, titanium, niobium, etc.) in the 2600 to 4500°F range. Successful sintering, hardening, annealing, and degassing at high production rates. Success stories all around!

The "Universal Atmosphere" has Universal Applications

Unlike other "atmospheres," vacuum has virtually no job limitations. Here's where the ingenuity of Hayes development engineers comes into play. By coordinating furnace design with job requirements . . . and by PROVING RESULTS in the Hayes lab . . . Hayes vacuum furnace engineers assure the customer a "RESULTS GUARANTEED" installation every time. I'd like to invite you to advance your heating into the "vacuum age" . . . with HAYES!



Write for vacuum Bulletin 5709A.

C. I. HAYES, INC.

Established 1905

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ELECTRIC FURNACES

It Pays To See Hayes for metallurgical guidance, lab. facilities, furnaces, atmos. generators, gas and liquid dryers.

TEAR OUT AND SAVE FOR FUTURE REFERENCE

HANDY CUTTING AND GRINDING FLUIDS GUIDE

FOR STANDARD, NON-FERROUS AND HARDENED METALS

OPERATION	DESIRED PROPERTIES & BENEFITS	RECOMMENDED PRODUCT
Automatic screw machining	Cutting oil that also serves as machine lubricant and hydraulic fluid. Transparency. No corrosion. EP properties.	**Cleartex**
Grinding 1. Oil grinding	Transparency. Accurate thread formation. Fine finish. Long oil life. Minimum wheel loading. No burning or surface discoloration of metal.	**Grindtex**
2. Internal, Cylindrical and surface grinding	Rust prevention. Minimum wheel loading. No oily residue. Can be used with fine-grit wheel.	**Cooltex**
3. Centerless grinding	Easy emulsibility. Stable emulsion. Rust prevention. Combined cooling and lubricating properties. No objectionable odor.	**Soluble Oil D or HW**
Broaching	Lubricating properties. Minimum chip welding. Extended broach life.	**Sultex or Transultex**
General Machining	Rust prevention. Cooling and lubricating effect for long tool life. Minimum distortion of work. Forms stable emulsion, resists formation of objectionable odors.	**Soluble Oil C or HD**
Quenching	High flash and fire point. Promotes uniform hardness. Good cooling. High oxidation resistance.	**Quenchtex**

FOR ALUMINUM AND MAGNESIUM

OPERATION	DESIRED PROPERTIES & BENEFITS	RECOMMENDED PRODUCT
Tapping Reaming Turning Boring Milling Grinding	Minimum metal distortion. No pile-up of chips on rake. Extended tool life. Dependable fine finish. Minimum recirculation of dirt and chips. High flash and fire point. No smoke. No odor. Non-irritating.	**Almag. For high-silicon aluminum alloys, use Transultex 60**

TUNE IN: TEXACO HUNTLEY-BRINKLEY REPORT, MON.-FRI.—NBC-TV

A Texaco Lubrication Engineer will be glad to help you do all your metalworking better, faster, at lower cost. Just call the nearest of the more than 2,300 Texaco Distributing Plants, or write Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

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Throughout the United States

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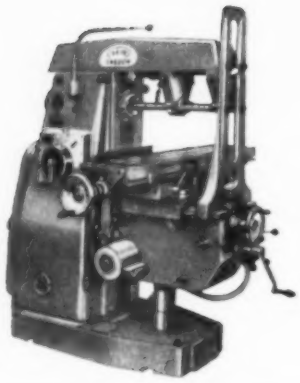
PAINSTAKING ATTENTION TO DETAIL
characterizes SAJO Millers

exemplified by the unsurpassed SAJO spindle construction employing double-row staggered roller bearings and ball thrust bearings — assures utmost stability and smooth transmission of full horsepower to cutter.

Available as
Plain, Universal & Vertical Millers.
Production Millers with automatic cycling.



No. 2 Universal Miller
table size: 52" x 11"
7½ and 1½ HP motors,
rapid power traverse.

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MSO **JIG BORING MACHINE**

WITH LEITZ OPTICS

Table size — 33½" x 18½"
Spindle speeds — 63 — 2000 RPM
Boring depth — 12"
Net Weight — 7500 lbs.

MSO The ULTIMATE in

precision

Setting accuracy .00002". Positioning accuracy .00012".

speed

Select any point as starting point. "Zero-in" scales by push button. Read scales to millionths without leaving operator's position.

ease

Direct reading on magnified screens in any quadrant from zero point. Table moves on double roller guides.

When only the best will do — check MSO first.

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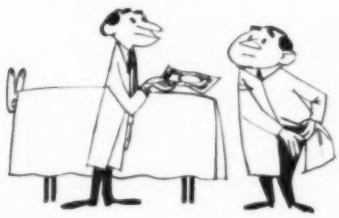
ting aluminum extrusions. Indiana territory will be handled by Donald McIntire, and Branch-Merwin Tool Specialists will cover the four-state area of Tennessee, Alabama, Mississippi, and Arkansas.

MEMOS

by BESS RITTER



"Stealing coppers from a dead man's eyes" is a now forgotten but once popular phrase, coined to describe just about the lowest type of thief imaginable. The old American custom of using pennies to close the eyes of a corpse was taken from the older English one.

It is also interesting to note that a copper was not used to close the eyes of President Lincoln, although the custom was quite prevalent in America at the time of his death. This was because it was believed that this metal was much too cheap for such a great man. So his eyes were closed with two silver half dollars instead.

Although mechanical refrigerators are considered to be modern, a model was patented in America all the way back in the 1850's, operated by a steam engine. It was called an "ice making machine" and it proved this by being able to produce blocks of ice one cubic foot in size when the out-of-door temperature was 80 degrees.

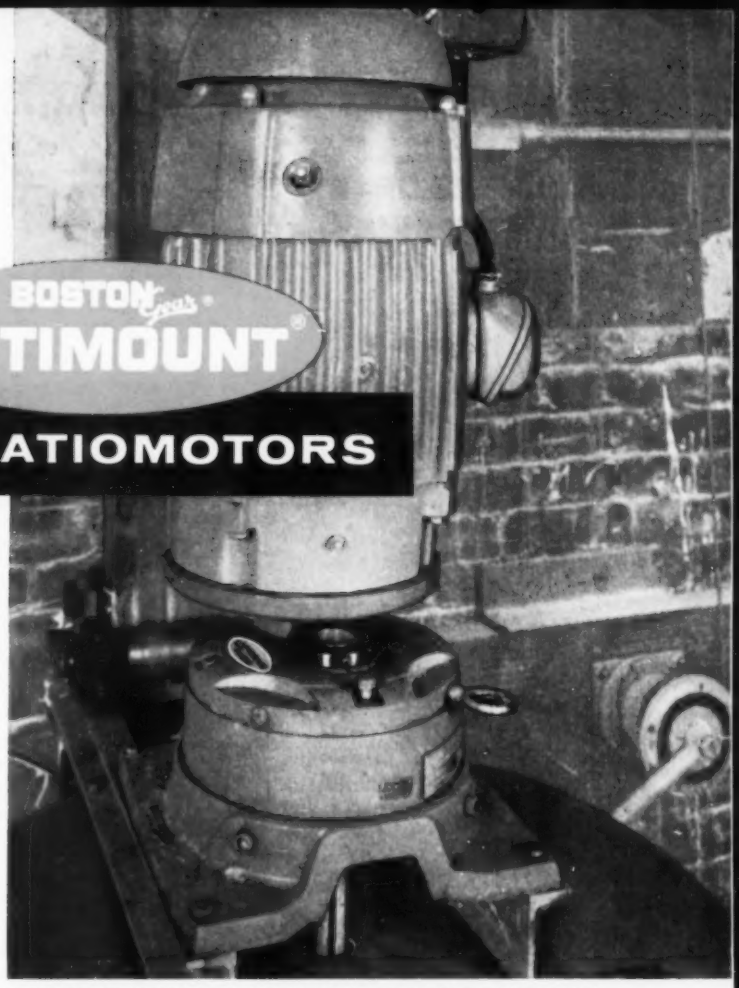
An odd piece of machinery was used in medieval days by the English housewife to keep her toddler-youngster from getting into trouble while Mama was engaged in her routine kitchen chores. Known as a "baby runner" it consisted of a pole from floor to ceiling. The pole revolved easily because holes were drilled in the floor and the ceiling to hold it upright. A piece of wood attached horizontally to the pole was firmly attached to the toddler by a ring around his middle. Now Baby could move happily (?) within the radius of his "runner."

When the job calls for
"~~gearhead motor~~"

cost-wise designers specify

BOSTON Gear
OPTIMOUNT®

HELICAL GEARED **RATIOMOTORS**



Add up the SAVINGS and see why . . .

YOU SAVE DESIGN TIME. Optional mounting gives full scope to your designing skill. Drive arrangements are not restricted by the mounting limitations of conventional gearhead motors.

YOU ELIMINATE EXTRA COST OF SPECIALS. With OPTIMOUNT Ratiomotors FROM STOCK, you can meet hundreds of unusual drive conditions that would require "specials" in conventional gearhead motors. You save the delay and extra cost.

YOU REDUCE PARTS COST. Since OPTIMOUNT offers a choice of many output shaft positions, you can design for direct lineup — and eliminate extra couplings, bearings, and other parts needed to "hook up" a conventional gearhead motor.

YOU SPEED PRODUCTION. Order the OPTIMOUNT you need with a phone call to your local Distributor, for delivery FROM STOCK. You can start production without delay, maintain schedules, and avoid big inventory expense.

YOU SIMPLIFY SERVICING. All OPTIMOUNT components are standardized stock parts — available promptly from over 100 BOSTON Gear Distributors throughout the U. S. and Canada.

Ask your BOSTON Gear Distributor for complete information. Boston Gear Works, 60 Hayward St., Quincy 71, Massachusetts.

VERTICAL BASE MOUNTED OPTIMOUNT RATIOMOTOR drives agitator blade shaft on pigment mixers in coated textiles plant. Manufacturer says: "OPTIMOUNT adaptability permitted simplified, efficient design for our specific needs . . . at a much lower cost for the complete installation."

Meet any in-line drive mounting conditions with STANDARD STOCK models

Vertical or horizontal base mounted — for any floor, wall, or ceiling mounting position — choice of many shaft positions in either base — single or double reduction helical gearing — for ¼ to 10 hp drives. Sold also without motor, ready for attachment of separately purchased motor of your choice.

Order from your nearby Distributor and get any arrangement you specify — ready to install

FROM STOCK!
at factory prices

Horizontal base mounted

Ask for Catalog No. 57

CALL YOUR NEARBY
BOSTON Gear
DISTRIBUTOR
— STANDARDIZATION PAYS —

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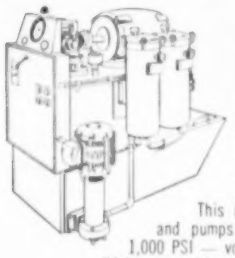
CIRCLE 255 READER SERVICE CARD

SEALOL
GUN DRILLING ACCESSORIES help you

DRILL FINISHED HOLES IN ONE PASS

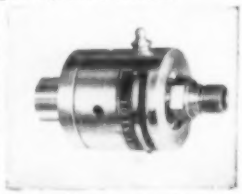
Adapt your present equipment for modern gun drilling with these specially designed gun drill accessories.



the original HI-PRESSURE COOLANT SUPPLY UNIT

The heart of any gun drilling operation is proper coolant in generous quantities. This unit filters, cools and pumps at pressures to 1,000 PSI — volumes to 40 GPM (higher capacities available).

END ATTACHED COOLANT TRANSFER



Attached to the outboard end of hollow spindle equipment to transfer coolant to the rotating gun drill. Pressures to 1,000 PSI and speeds to 10,000 RPM.

GUN DRILL ADAPTOR

Not illustrated—for solid spindle equipment. The coolant transfer is integral with the adapter spindle.

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MACHINES AND ATTACHMENTS

1 ROLL GRINDING—*Landis Tool Co, Waynesboro, Penna.* 22-page bulletin RG-59 gives correct procedure for grinding the body of mill rolls. Contains information on speeds, feed rates, traverse speeds, work speeds, wheel dressing, coolants, lubrication, wheel conditioning, and the effects of hard and soft acting wheels.

2 TURRET DRILLING — *Brown & Sharpe Mfg Co, Turret Drilling Division, 20 Fitch St, East Norwalk, Conn.* 20-page bulletin T-102, "Drama in Drilling," presents case histories of applications on turret drilling machines; describes tooling employed and discusses operations and time required. Applications include random hole patterns in one, two, and many planes, concentric bolt circles (flat surfaces and at different angles) and straight line hole patterns with photos of tooling and drawings of parts. Principles explained; description of B&S's tooling clinic included.

3 ACCESSORIES FOR HYDRAULIC MACHINES — *Baker Brothers Inc, 1000 Post St, Toledo 10, Ohio.* Brochure illustrates and describes a number of accessories which vary the standard cycles of hydraulic drilling and tapping machines. Available for both vertical and horizontal models, items include a time delay and reverse, a jump feed cam, reverse feed mechanism, hydraulic tapping unit, leadscrew tapping attachment, sequence drill and tap spindles, and step drilling unit.

4 AUTOMATIC THREADING ATTACHMENT — *Jones & Lamson Machine Co, Machine Tool Division, Springfield, Vt.* 6-page bulletin CO-5913 pictures and describes features of the Auto-Threader that enables J&L turret lathes to perform single point thread chasing with completely automatic cycle.

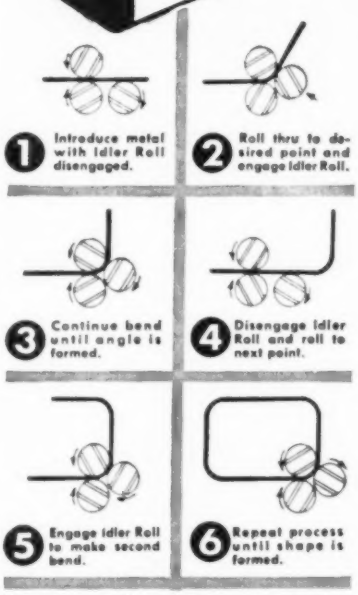
5 PRESSURE VESSEL FABRICATION—*Airite Products Inc, 8516 E Olympic Blvd, Los Angeles 22, Calif.* 12-page illustrated bulletin 141 discusses new techniques for making titanium, stainless steel, and alloy steel pressure vessels. Performance chart is included, plus a full-page nomograph for approximating weights of vessels in various materials.

6 TENSILE-TESTING MACHINES — *Steel City Testing Machines Inc, 8817 Lyndon Ave, Detroit 38, Mich.* 4-page illustrated bulletin T-859 describes line with capacities up to 40,000 lbs. Specifications, descriptions, and methods of operation listed for manual and motorized hydraulic models. Covers procedures for calibrating and using for compression tests.

(continued on p155)

"Didn't you ever have one of those days when everything seems to go right?"

HOW TO FORM
a rectangular shape with the
DI-ACRO ROLLER


1 Introduce metal with Idler Roll disengaged.
2 Roll thru to desired point and engage Idler Roll.
3 Continue bend until angle is formed.
4 Disengage Idler Roll and roll to next point.
5 Engage Idler Roll to make second bend.
6 Repeat process until shape is formed.

Forming small and large circles without flat spots and a variety of other sheet metal shapes is easily accomplished on the Di-Acro Roller with its *exclusive cam actuated Idler Roll*. Rear roll indicators allow operator to quickly return to a previous setting. Eight models from 6" to 42" forming width.

NEW DI-ACRO POWER ROLLERS

Increase speed and efficiency. Forward, stop and reverse are governed by foot control leaving both hands free for feeding materials. Six sizes from 12" to 42" wide all with 2" ground and polished forming rolls.

For six page roller folder call your nearest Di-Acro dealer listed in the yellow pages under Machinery—Machine Tools or write to us.

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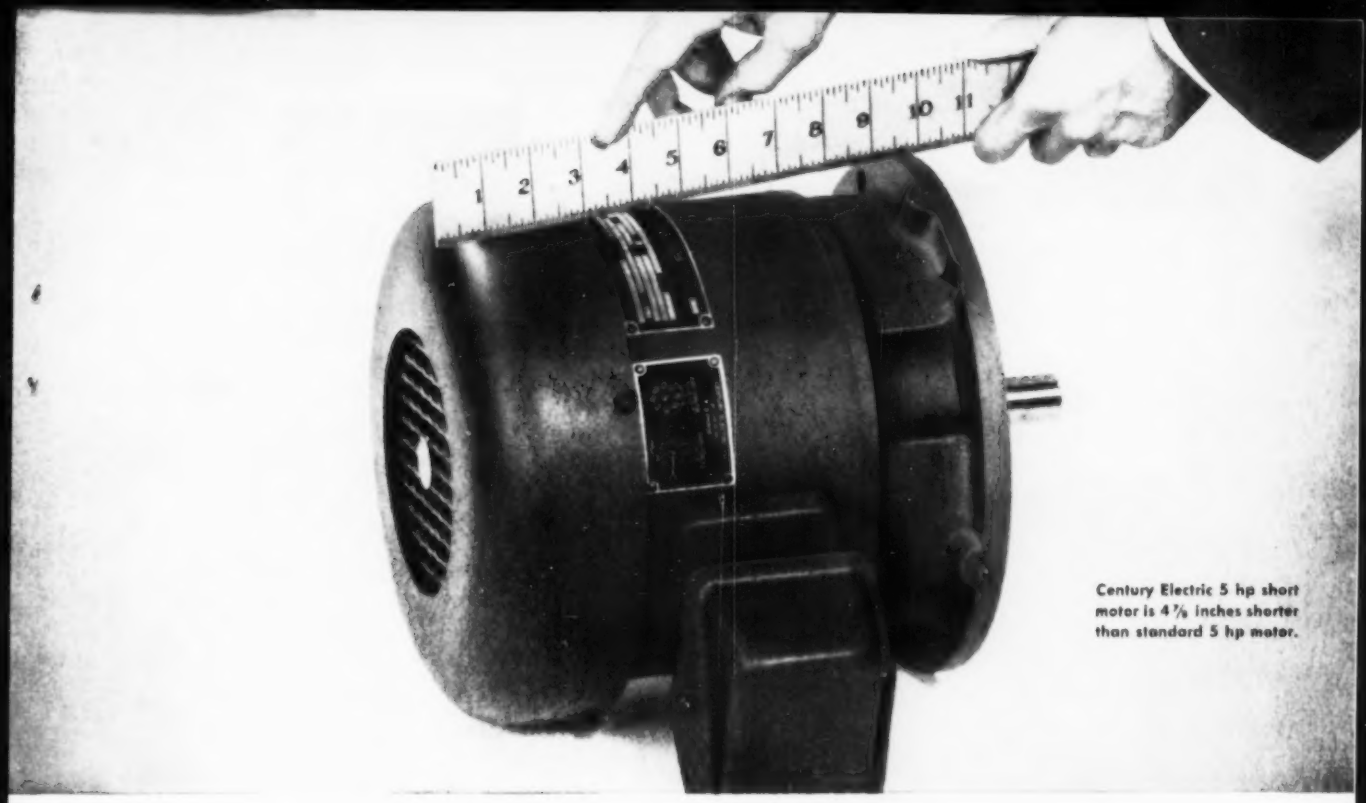
di-acro PRECISION METALWORKING MACHINES

O'NEIL-IRWIN MFG. CO.
311 8th Avenue
Lake City, Minnesota



Century Electric 5 hp short motor is 4 7/8 inches shorter than standard 5 hp motor.

This new Century Electric motor is up to five inches shorter

(above) Standard flange gives flexibility in mounting. Motor can be installed horizontally or vertically.

(below) This compact power roof exhauster is typical of applications for short motors.

You have greater product design freedom with the new Century Electric short motor. It is two and a half to five inches shorter, but has all standard integral motor features. Here are the benefits:

Save space and weight— Your product can be smaller, lighter, a different shape . . . because the new motor is up to 35% shorter and has less bulk and overhang. Means you also reduce handling costs—both in receiving motors and shipping your product.

Easy mounting— You can use this motor in place of any standard end-mounted motor because it has a standard flange. It can also be mounted horizontally, vertically, or at any angle. Its small size makes it possible to mount the motor in a variety of places on equipment.

Variety of applications— You can get the new Century Electric short motor in totally enclosed or open frames and in ratings up to 15 hp. You can use it on many applications such as machine tools, roof ventilators, pumps and centrifuges. And it has the same quality features and high standards of all of Century Electric's complete line—up to 400 hp.

More than a motor— This motor is the result of a continuing search for ways to meet industry's needs. Another reason why you get more than a motor from Century Electric.

For more information, contact your nearest Century Electric Sales Office or Authorized Distributor.

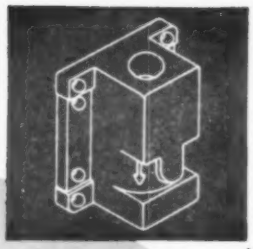
CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

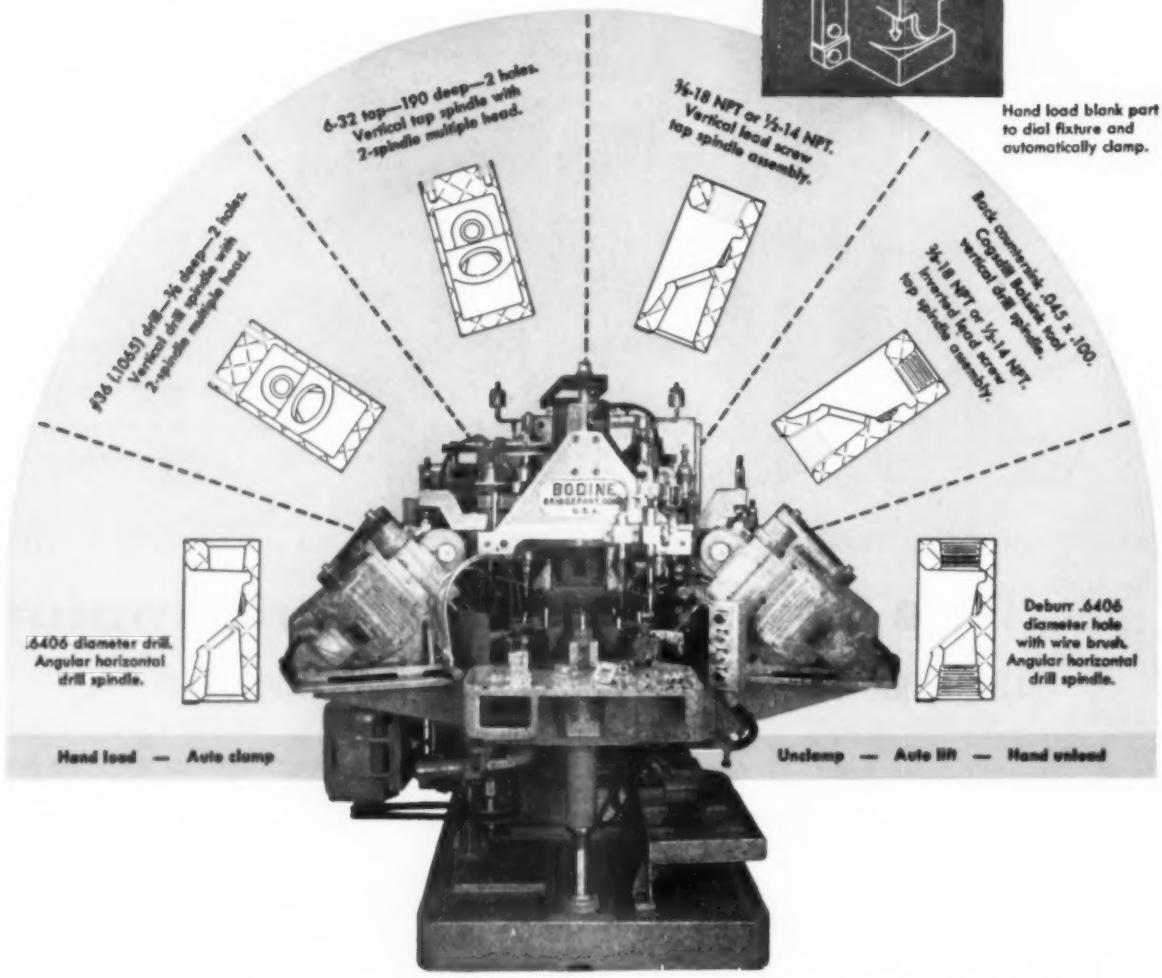
CIRCLE 258 READER SERVICE CARD

Century 59-3

Bodine case history no. 46



Hand load blank part to dial fixture and automatically clamp.


6-32 tap—.190 deep—2 holes. Vertical tap spindle with 2-spindle multiple head.
⅜-18 NPT or ½-14 NPT. Vertical lead screw tap spindle assembly.
Back counterbore .045 ± .100. Coquille Balance tool vertical drill spindle.
⅜-18 NPT or ½-14 NPT. Inverted lead screw tap spindle assembly.
#36 (.1065) drill—½ deep—2 holes. Vertical drill spindle with 2-spindle multiple head.
.6406 diameter drill. Angular horizontal drill spindle.
Deburr .6406 diameter hole with wire brush. Angular horizontal drill spindle.
Hand load — Auto clamp
Unclamp — Auto lift — Hand unload
BODINE
BRIDGEPORT CONN. U.S.A.

Good way to hold a winning hand

in competitive manufacturing.

This major manufacturer of automatic control equipment has used cost-reducing Bodine Basic Machines and tooling methods for many years.

The interesting new Bodine unit shown above went in to replace another machine . . . to include MORE OPERATIONS, performed at a FASTER RATE.

The new machine features recently-developed Bodine reversing motor-driven lead screw spindles . . . one vertical and one inverted. The valuable versatility of Bodine tooling with combinations of vertical, angular and inverted spindles is clearly demonstrated.

This is also an example of how advanced Bodine tooling is constantly stepping ahead of production demands, even among present Bodine users. In all cases, such tooling is readily adapted to present Bodine Basic units, an important cost-advantage users of our equipment enjoy.

If you have a part you would like to produce better at lower cost, send us a sample and prints for analysis. No cost or obligation. Write Dept. AM-11.

MATERIAL and PART: Zinc die-cast valve body.

PRODUCTION: 15 complete pieces per min.; 6000 operations per 50-min.hr.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

Free Literature

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TOOLS AND ACCESSORIES

7 PRECISION CHUCKING DEVICES —*Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 4-page circular 634 contains description of features and advantages of devices that hold, center, and round up large-diameter precision components for inspection or machining. Units have been produced in sizes that range from 8 in. in diameter to 50 in.; other sizes can be made to meet any specific requirements. Square collet jaws are normally furnished, but shaped jaws to fit complex contoured surfaces can also be supplied.

8 DIAMOND WHEELS, SAWS, HONES — *J K Smit & Sons of Canada Ltd, 81 Tycos Drive, Toronto 19, Canada.* 24-page catalog 65 contains diagramatic drawings and tabular data that covers wheel number, dimensions, and bonds of a number of types. Care and maintenance of diamond wheels discussed as well as wheel marking, catalog numbers, and analysis of type designations.

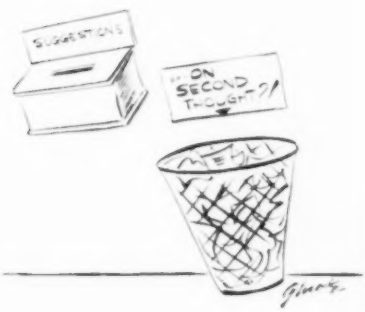
9 WORKHOLDING TOOLS — *Chicago Tool & Engineering Co, 8383 S Chicago Ave, Chicago 17, Ill.* Catalog 27 covers complete line of more than 68 Palmgren products including drillpress vises, angle vises, swivel machine vises, adjustable angle plates, rotary tables, milling tables, tilting tables, lathe milling attachments, and other machine tool accessories. Specifications and net prices included.

10 DIAMOND DRESSING TOOLS — *Wheel Trueing Tool Co, 3200-316 W Davison Ave, Detroit 38, Mich.* Literature gives information on Tru-Grit line made to user specifications for dressing form, straight face, and thread grinding wheels.

● SCIENTIFIC INSTRUMENTS, APPARATUS, SUPPLIES — *Ealing Corp, 40 University Rd, Cambridge, Mass.* 112-page catalog contains specifications for over 300 products including items for measurement, mechanics, wave motion, acoustics, heat and thermodynamics, optics, electricity and magnetism, atomic and nuclear, and mathematical aids and instruments. New supplements issued quarterly. Request direct on company letterhead.

11 PUNCHES AND DIES — *Whitney Metal Tool Co, 110 Forbes St, Rockford, Ill.* 1960 catalog shows styles, features, dimensions, and prices. Includes die shoes, punch holders, strippers, and die adaptors.

12 DATA PROCESSING EQUIPMENT —*Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Penna.* 48-page Preliminary Technical Publication N-07(1) describes equipment in use including digital data processing and analog and digital



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Precision drilling holes at a minimum cost, without loss of accuracy in hole alignment and surface finish, requires gun drills of absolute uniformity.

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Highest precision manufacturing on exclusively developed equipment and complete research facilities, assure you dependence on uniformity, quality and reliability.

If you are looking for a solution to your 'hole' drilling and finish problem, specify ELDORADO GUN DRILLS.

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OA Lengths	4" to 120" with dia. limits	10", 16", 22", 36"	16", 22", 36"
Drivers	Std. or to fit your need	.750" dia. x 2 3/4" long	1" dia. x 2 3/4" long
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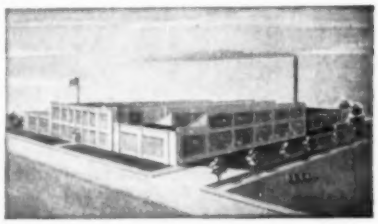

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computing systems. Illustrated literature explains types of inputs, input switching, output devices, and modes of operation for range of applications.

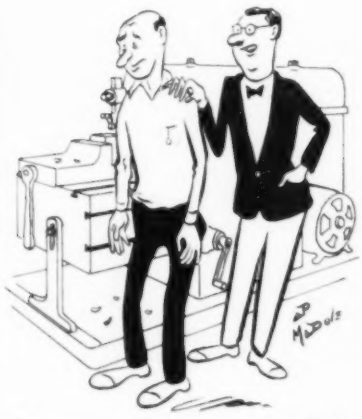
13 COMPILER FOR ELECTRONIC COMPUTER — *Royal McBee Corp, Data Processing Division, Port Chester, NY.* 18-page Manual S-520 contains technical data on the Act I, a new compiling routine and translator for the Royal Precision LGP-30 electronic computer. Programming with the compiler can be learned in a day. Through its operation, any problem can be submitted to the computer in simple algebraic form. Compiler is fed into the LGP-30's 4096-word internal memory on punched tape and translates problems to the machine language automatically. Act I is capable of compiling fixed or floating point programs.

14 MAGNETIC TAPE RECORDER/REPRODUCER—*Consolidated Electrodynamics, 360 Sierra Madre Villa, Pasadena, Calif.* 10-page illustrated bulletin 1576 describes Type 5-752, a complete system in a single cabinet that handles seven different types of record and reproduce amplifiers for analog, FM, or PDM modes of operation; it can be adapted to PCM (Digital). Physical and operating features discussed; specifications detailed.

15 MAGNETIC TAPE TENSIOMETER —*General Kinetics Inc, 555 23rd St South, Arlington 2, Va.* Brochure contains information on Model K-44 that allows measurement and recording of transient and steady-state tensions applied to magnetic tape by recorder transports. Instrument measures running tension variations as small as 1/100 oz, starting tension transients as large as 8 lbs, rising to peak in less than 1 milli-second. Similar instruments can be supplied for measurement of force, acceleration, and pressure.

16 COLLETS—*Benco Collet Manufacturing Co, Cleveland 14, Ohio.* Catalog 59 illustrates and describes major products including collets, pushers, feed fingers, and pads for all types of screw machines as well as lathe collets.

17 CARBON DIOXIDE ENVIRONMENTAL TESTING—*Pure Carbonic Co, Division of Air Reduction Co, 150 E 42nd St, New York 17, NY.* 6-page brochure, Form ADPC 44 covers applications of CO_2 for low-temp testing. Illustrates and describes the four principal methods:



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Once you've tried
Jetweld Low-Hydrogen Electrodes,
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There's no such thing as hard-to-weld steel!

Sulphur-bearing steels that normally can't be welded without porosity—

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All are welded easily and successfully, in any position, with Jetweld Low-Hydrogen rods.

An iron powder coating makes for fast, smooth operation.

And three tensile classifications handle every Low Hydrogen application.

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Try them for the very finest physical properties and on steels you thought were tough to weld.

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CIRCLE 262 READER SERVICE CARD

CLAUSING COLCHESTER GEARED-HEAD LATHES

HERE'S PROOF OF PERFORMANCE *from Anderson Duggar, Jr., president of Equitable Engineering Co. — "How do we like our Clausing 15" geared-head lathe? We want another just like it! Our people really surveyed the market thoroughly before deciding on the Clausing — believe me, it's everything it looked to be and more. The Clausing is an extremely accurate lathe and its features and ease of operation are making us money."*

Clausing geared-head lathes do lead their field in capacity, performance and value. Here's why:

They're bigger in capacity than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. 17" lathe spindle, for example, has 3-1/16" thru hole – 15" lathe, 2-1/16" hole – 13", 1-9/16" hole.

Have heavy-duty construction throughout. Bed ways are induction hardened. Gears in head and quick-change box run in bath of oil. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile steel.

Built for precision performance – to American standards of toolroom lathe accuracy. Have Gamet Micron tapered roller bearings with oil flow lubrication – the most advanced and accurate bearings known to industry.

Each is an outstanding value. 13" cabinet base models, including motor and controls, start at $2302; 15" cabinet base at $3221; 17" at $5070. You owe it to yourself to investigate before investing in *any* lathe.

Lathe Capacities: 17" lathe: 54" and 78" centers, 28" swing in gap; 15" lathe: 30" and 48" centers, 24" swing in gap; 13" lathe: 24" and 36" centers, 18" swing in gap.

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direct injection of CO_2 bulk liquid; use of syphon cylinders or Dry-Ice Liquidors; direct cooling with Dry-Ice; and the use of CO_2 liquid or Dry-Ice to chill a low-freezing circulating fluid.

18 WRENCHES—*Lowell Wrench Co, Worcester 4, Mass.* 11-page catalog 62 covers complete line of reversible ratchet wrenches including the new ½-in. square drive socket sets available in 10-point and 12-point sizes. Includes simplified method for figuring correct wrench size for any bolt or nut diameter.

19 MICROMETERS—*J T Slocomb Co, 10 Matson Hill Rd, South Glastonbury, Conn.* 4-page bulletin 24 contains illustrated information on standard micrometer calipers ranging from 1 through 60 in. together with many special micrometers including the snap gage, air foil, sheet metal and others. Data provided on the Speedmike, a direct reading micrometer.

HEAT TREATING AND WELDING

20 ELECTRIC ELEVATOR FURNACES—*General Electric Co, Schenectady 5, NY.* 4-page bulletin GED-3991 presents illustrated description of complete line of units for batch annealing of standard and pearlitic malleable iron. Advantages and features discussed, major construction and operating details pictured. Charts show typical annealing cycle and available sizes.

21 SHUFFLE HEARTH FURNACE—*Sunbeam Equipment Corp, 180 Mercer St, Meadville, Penna.* 4-page bulletin SEC-7 illustrates and describes unit for automatic heat treating and quenching. Furnace is used for hardening and carbonitriding within an operating temperature range of 1400 to 1800 F. Specifications and sizes in chart form.

22 WELDING AND CUTTING APPARATUS—*National Cylinder Gas Division, Chemetron Corp, 840 N Michigan Ave, Chicago 11, Ill.* 16-page catalog NR-175 gives information on individual Rego items and welding, cutting, or combination outfits. Illustrates torches, cutting attachments, tips, flowmeter, regulators, refrigerant leak detector, blowpipes, and gas shut-off valves. Rego outfits are groups of individual items which operate in conjunction with each other. Literature lists and describes industrial gases available.

"You'll be working a little overtime this evening, Denny. The company will pay for your dinner and breakfast."

QUICK COMPARISON

CHART Some unique combinations of electrical and physical properties in Anaconda metals that may save you money—handle tough jobs better

Properties shown for precipitation-hardened condition—Heat-treatable alloys	ELECTRICAL CONDUCTIVITY % IACS	TENSILE STRENGTH psi	YIELD STRENGTH at 50% ext. under load, psi	ELONGATION % in 2 in. or 4xD	MACHINABILITY compared with F.C. Brass at 100	FORMS AVAILABLE
Chromium Copper-999 (Cu 99.05%, Cr .85%, Si .10%)	75	65,000	55,000	20	20	Rod Wire Tube Forgings Strip
Leaded Nickel Copper-831 (Cu 97.8%, Pb 1.0%, Ni 1.0%, P .2%)	55	80,000	70,000	7	80	Rod
Cunisil-837 (Cu 97.5%, Ni 1.9% Si .6%)	30 to 42	90,000	70,000	8	40	Rod

To give you a basis of comparison, here are properties of two standard Anaconda electrical coppers

ETP Copper—100 (Cu 99.9+%)	100	48,000	40,000	15	20	All mill forms
Leaded Copper—126 (Cu 99.0%, Pb 1.0%)	98	48,000	40,000	12	80	Rod bar

The values given above are intended as a guide to some unusual combinations of electrical and physical properties available among Anaconda alloys. If any of them gives you an idea for possible solution to a tough problem or indicates a way to cut costs without sacrificing quality or performance — see your American Brass representative for more details. Or send in this coupon today.

COPPER • BRASS • BRONZE • NICKEL SILVER MILL PRODUCTS

ANACONDA®

PRODUCTS

Made by The American Brass Company

The American Brass Co., Waterbury 20, Conn.
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Please send me more information about the following alloys:

- ☐ Chromium Copper—999
- ☐ Leaded Nickel Copper—831
- ☐ Cunisil—837
- ☐ Leaded Coppers
- ☐ Electrolytic Tough Pitch Copper—100

Name

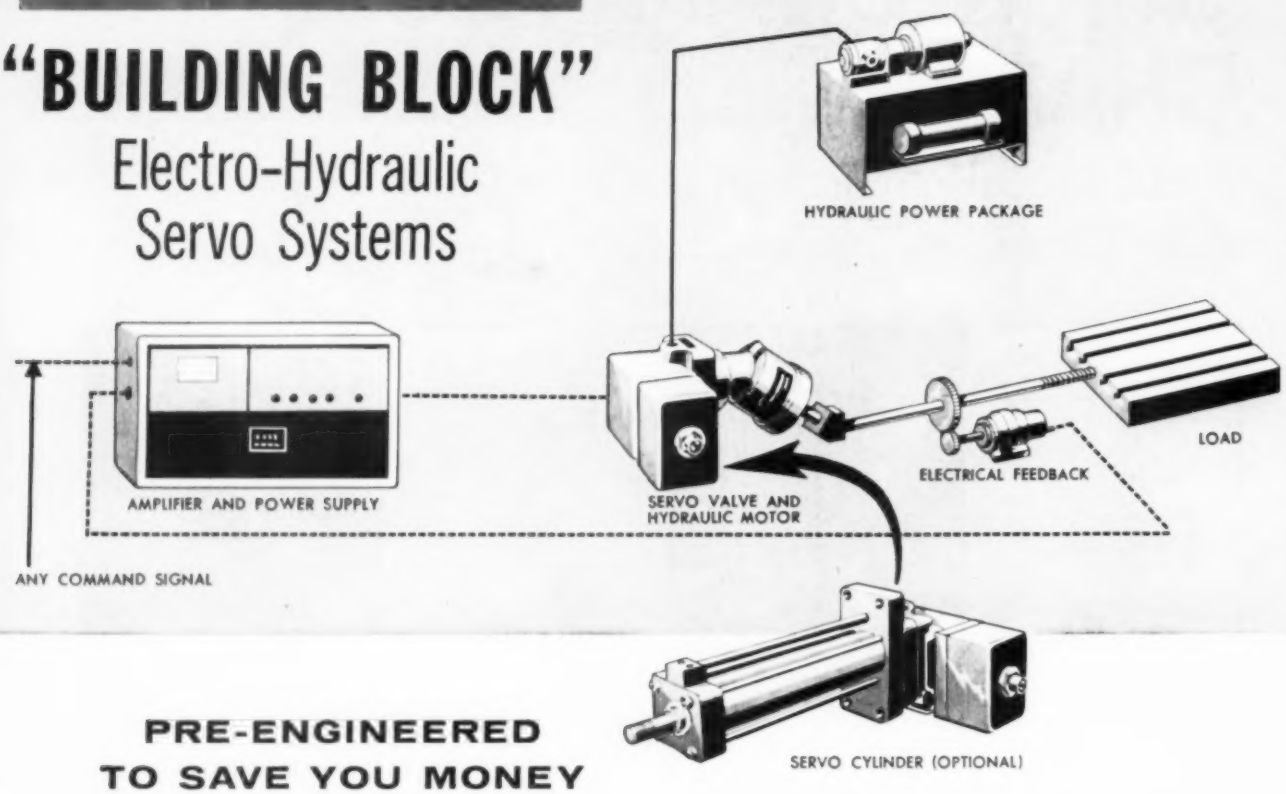
Company

Street

City Zone State

A NEW CONCEPT

"BUILDING BLOCK"
Electro-Hydraulic Servo Systems



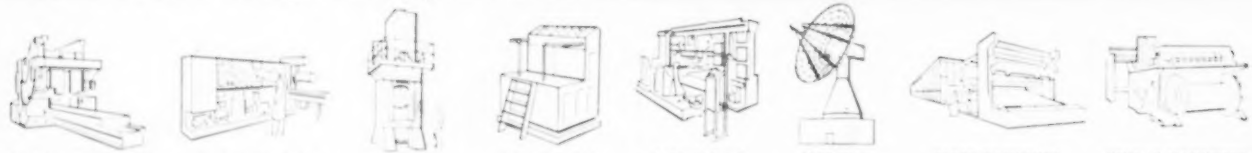
PRE-ENGINEERED TO SAVE YOU MONEY

Standard hydraulic and electrical components are now pre-engineered into a series of complete and dependable Electro-Hydraulic Servo Systems. Vickers has the most extensive line of individual "building block" components available for such systems. Inherent "trim flexibility" makes possible systems which will satisfy a very wide range of application . . . at only a fraction of the cost usually incurred in specially engineered systems. A very substantial saving in lead time is now possible.

Vickers "Building Block" Closed Loop Servo Systems have proved their merit on machine tools, fabricating machines and processing equipment. The amplifier is precisely matched to the servo valve torque motor. The work load requirement is continuously monitored by electrical feedback devices to insure that directions (command signals) are accurately followed at all times.

Positional accuracy of better than .001 is obtainable with a hydraulic motor and lead screw. In many position applications, cylinders can be used with similar accuracies. Velocity can be maintained within one or two rpm. In addition to position and velocity controls now in service, constant horsepower and constant tension systems soon will be available. Any command signal may be used with these systems . . . from a simple potentiometer to complete numerical control. For further information, ask for Engneering Bulletin No. 59-75.

wide range of applications



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8356

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

CIRCLE 265 READER SERVICE CARD

Gleason Works, Rochester, NY, has elected **Lawrence C Gleason** (left) to the office of president and general manager. Mr Gleason has been president since 1958. **Howard F Carver,** a vice president of the company, has been elected to the post of vice president and assistant general manager. **Dwight Vandevate,** former vice president and general manager, has resigned from the organization

Brown & Sharpe Mfg Co, Providence, RI, has named **Joseph E Kochlan** assistant general sales manager of the Industrial Products Division. He was formerly director of systems and audits

NAMES IN THE NEWS...

Cleveland Punch & Shear Works Co has elected **C E Huddleston** executive vice president. He was formerly chief engineer.

Chrysler Corp has named **Kenneth S Crawford** manager of the Plymouth Detroit assembly plant. Formerly production manager there, he succeeds **William C Cawthon,** recently appointed general purchasing agent for the corporation.

H Stanley Johnson has retired as executive vice president of Gisholt Machine Co, Madison, Wis. A grandson of John Anders Johnson, founder of the company, and brother of George H Johnson, Gisholt president, he has recently completed 35 years of service in various capacities including the posts of treasurer, and vice president and treasurer. Mr Johnson will continue as a member of the board of directors.

Narda Ultrasonics Corp, Westbury, NY, producer of ultrasonic cleaning equipment, has appointed **Walter H Venghaus** vice president and manager of manufacturing. Prior to joining the company Mr Venghaus was associated with National Research Associates Inc, College Park, Md.

American Motors Corp has named **Edward J Ferch** assistant works manager of the Kenosha, Wis, plant. Formerly superintendent of standards of the Automotive Division, he succeeds **Walter F Tobias** who has retired.

Pratt & Whitney Co, West Hartford, Conn, has named **Edward J Ferris Jr** (left) factory manager and **Earl R Lewis Jr** production manager. They will be responsible for coordinating all manufacturing operations and production department activities within the company's machine tool, cutting tool, and gage divisions. Mr Ferris was formerly factory manager of the machinery division and Mr Lewis production manager of the cutting tool and gage divisions

E W Buschman Co, Cincinnati conveyor manufacturer, has elected **Rudy B Vogt** president to succeed the late **E W Buschman.** Mr Vogt was previously vice president in charge of development and sales.

Ingersoll-Rand Co has appointed **W T Alderson** vice president of the company with headquarters in New York. He was previously manager of the compressor engineering department.

New York Air Brake Co has promoted **Howard W Brandt** to the post of vice president. Formerly general manager of the company's Hydreco Division in Kalamazoo, Mich, he will continue to direct activities there.

Producto Machine Co, Bridgeport, Conn, has named **J Brandon Shaw** eastern sales manager. He was formerly branch manager in the Philadelphia assembly plant.

General Motors Corp has elected **Harold R Boyer** a vice president and appointed him general manager of the Defense Systems Division. He was formerly director of military products.

Waldes Kohinoor Inc, Long Island City, NY, manufacturer of fastening devices, has appointed **Howard Roberts** manager of engineering services for the Truarc Retaining Rings Division. He was formerly engineering representative for the Mid-Atlantic states.

Siegler Corp, Los Angeles manufacturer of electronic equipment, has elected **Robert K Miller** a vice president of the organization. Mr Miller

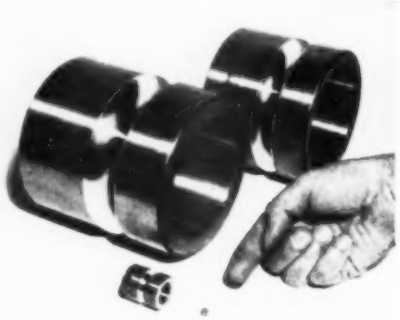
WHY MICROHONE*

YOUR CRITICAL ANTI-FRICTION BEARING SURFACES? BECAUSE...

Bearing loads and speeds, in common use today, demand critical bearing surfaces that are accurate, have correct geometry and proper surface finish. Also, the process that generates these surfaces must keep production costs to a minimum.

MICROHONING INCREASES PRODUCTION

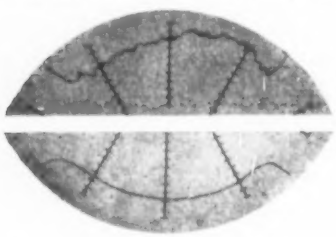
Microhoning is the first successful method for automatic processing and handling of raceway rings on multiple machines. It increases production several times over output of former methods.



Raceways of inner and outer rings for ball diameters ranging from .062" to 1.50" are currently being Microhoned.

MICROHONING IMPROVES BEARINGS

The ability of Microhoning to greatly improve the functional characteristics of critical bearing surfaces is even more significant. For instance . . . quieter-running, longer-life ball bearings are obtained because Microhoning of races assures:



Comparative Talyrond charts—each division of radial lines equals 50 millionths of an inch. Top: raceway curvature of a finished, unhoned precision bearing. Bottom: curvature of Microhoned raceway.

1 Improved concentricity between raceway and bore;

2 Removal of humps in raceway and trueing of plane of track;

3 Correct track curvature for greater contact with balls;

4 Simultaneous improvement of accuracy and surface finish.

Critical checking on precision instruments, and comparative performance studies have convinced many bearing makers and users that Microhoned bearings run smoother, quieter, and longer than those processed by any other method.

**Registered U.S. Pat. Off.*

For further information, write to:

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

NAMES IN THE NEWS...

has been serving as president of the Holly-General Division which manufactures heating and air conditioning equipment at Pasadena, Calif. He will continue to head the division in addition to his new duties.

Brown & Sharpe Mfg Co, Providence, RI, has appointed **Axel Christensen** sales manager, Brown & Sharpe Ltd. He will make his headquarters in Plymouth, England. Mr Christensen was formerly international machine tool representative stationed in Providence

Firth Sterling Inc, Pittsburgh, has appointed **R K Hopkins** vice president and general manager of the Steel Division.

Society of Plastics Engineers has elected **George W Martin,** Holyoke Plastics Co, Holyoke, Mass, SPE president for 1960. **Frank W Reynolds,** IBM Corp, Endicott, NY, has been named first vice president of the Society and **Haiman S Nathan,** Atlas Plastics Inc, Buffalo, second vice president.

Strong, Carlisle & Hammond, Conneaut, Ohio, division of White Sewing Machine Corp, has appointed **Joseph P Stroz** chief engineer. Company makes steam specialties and units for liquid and gas flow control. Mr Stroz has been associated with the Special Products Division of White for the past year and a half.

Garrett Corp has named **Jack Wright** assistant manager of its AiResearch Industrial Division, Los Angeles. He was previously manager of Garrett's Aero Engineering Division in Mineola, NY.

Connor Spring Manufacturing Co, San Francisco maker of precision springs and wire forms, has elected **Charles V O'Hara** president. He was

formerly San Francisco Division manager. **Marshall W Christen,** manager of the Los Angeles Division, has been named vice president.

Florence Pipe Foundry & Machine Co, Florence, NJ, manufacturer of pipe, fittings, valves, hydraulic and other machinery, has elected **Warren A Brown** president of Florence and its subsidiary, the **R D Wood Co,** Philadelphia. Mr Brown, Florence vice president, succeeds **E Roy Russell** who has retired.

National Electric Welding Machines Co, Bay City, Mich, has promoted **Paul Thorne** from chief electrical engineer to chief electrical and development engineer. **Harold Bach,** manager of the service and research section, has been named chief welding engineer.

Ford Motor Co of Canada Ltd has named **James K Ronson** general manager of the company's car and truck assembly plant at Oakville, Ont. He was previously director of automotive engineering and quality control for the company.

Crown Cork & Seal Co, Philadelphia, has named **Roscoe H Bowers** director of engineering. He has been heading the company's program of modernization, relocation, and expansion of manufacturing facilities.

Packard Bell Electronics, Los Angeles, has appointed **John M Evans** manager of special products manufacturing in the Technical Products Division. Prior to joining the company he was a production superintendent at Bendix Computer.

Ex-Cell-O Corp, Detroit, has named **Andrew J Kirchner** manager of export sales to succeed **Stewart J Elliott** who has retired. He moves up from the post of assistant to the export sales manager.

Society for Nondestructive Testing has elected **Donald T O'Connor** president. Mr O'Connor is chief engineer, X-ray Section, at Machlett Laboratories Inc, manufacturer of large vacuum tubes.

Dole Valve Co, Morton Grove, Ill, has appointed **J K Lund** vice president of the Research and Development Division. He was formerly vice president and director of technical services.

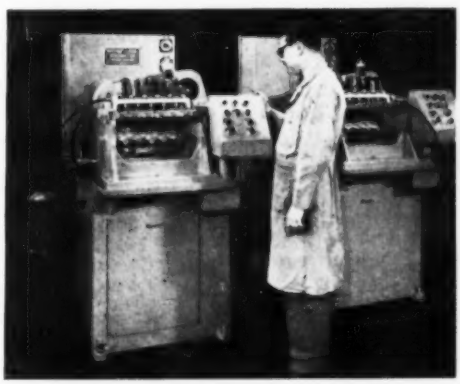
OBITUARY

Charles J Weber, president and cofounder of Chicago Gear Manufacturing Co, died Oct 31.

MICROHONING* OF CRITICAL BEARING SURFACES ASSURES QUIETER-RUNNING, LONGER-LIFE

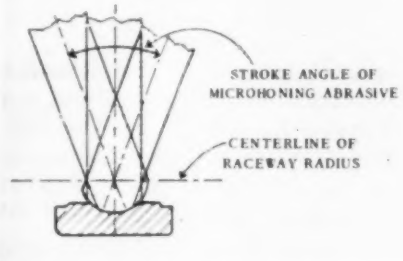
Because Microhoning is the first successful method for automatic processing and handling of anti-friction raceway rings on multiple spindle machines, production is several times higher than former methods.

In addition, here's how application of basic Microhoning principles (a combination of motions, low-velocity abrading, controlled pressure, float in tool) improve the functional characteristics of bearings: concentricity, track curvature, waviness, accuracy, surface finish.



Typical five-spindle machines for Microhoning bearing raceway. Typical production: bring high-band reading (Waveometer) of raceway waviness below one microinch, rms . . . five rings in a 20-second cycle.

Tools are positioned on an oscillating bridge so that abrasive sticks pivot about the centerline of raceway arc to generate a true radius. As rings rotate, irregularities are removed from track leaving a clean surface that is free of smeared or deformed metal. During final seconds of Microhoning cycle, speed of oscillation is automatically reduced to generate a lay pattern that runs circumferentially around the track.



Because abrasive stick pivots about centerline of raceway while rings are rotating, Microhoning improves raceway curvature, waviness, surface roughness and lay.

Microhoning technique can also be applied to raceways of cylindrical roller, tapered roller, needle, thrust and self-aligning bearings . . . also, other critical bearing surfaces.

For further information, write to:

**Registered U.S. Pat. Off.*

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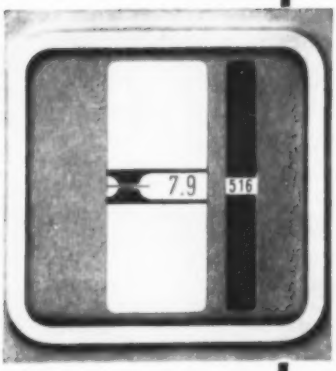
DECKEL *LK Machine Tool Series Brings You...*

Direct Numerical Readings To .0001"

And Interchangeable Heads

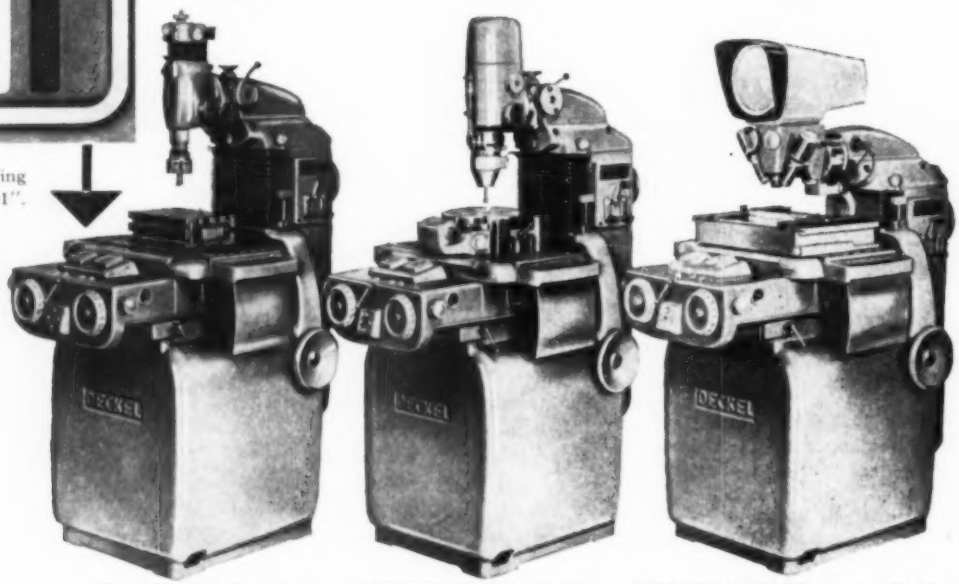
for

Optical Coordinate



Projection screen showing scale readings to .0001".

Jig Boring **Jig Grinding** **Profile Measuring**



DECKEL LKB Jig Borer
Worktable area: 25.6" x 11.8"

DECKEL LKS Jig Grinder
Worktable area: 25.6" x 11.8"

DECKEL LKM Measuring Machine
Magnification: 10X, 20X

This outstanding machine tool development couldn't be more timely. The new DECKEL LK series of optical coordinate machine tools combines economy with extreme precision—at a time when these two factors are highly critical.

Three Machines In One—Simple interchangeability of jig boring, jig grinding and profile measuring heads gives you a choice of one, two or three machines on one universal base. Change from one head to another takes only minutes. Used individually, each one of these machines will give you remarkable accuracy and performance.

Direct Numerical Readings—For the first time on any machine tool, coordinate table settings *can be read directly in numbers* to ten-thousandths (.0001") of an inch. No conversions or interpolations are needed. Reading errors are practically impossible. Actual positioning accuracy is within .00012".

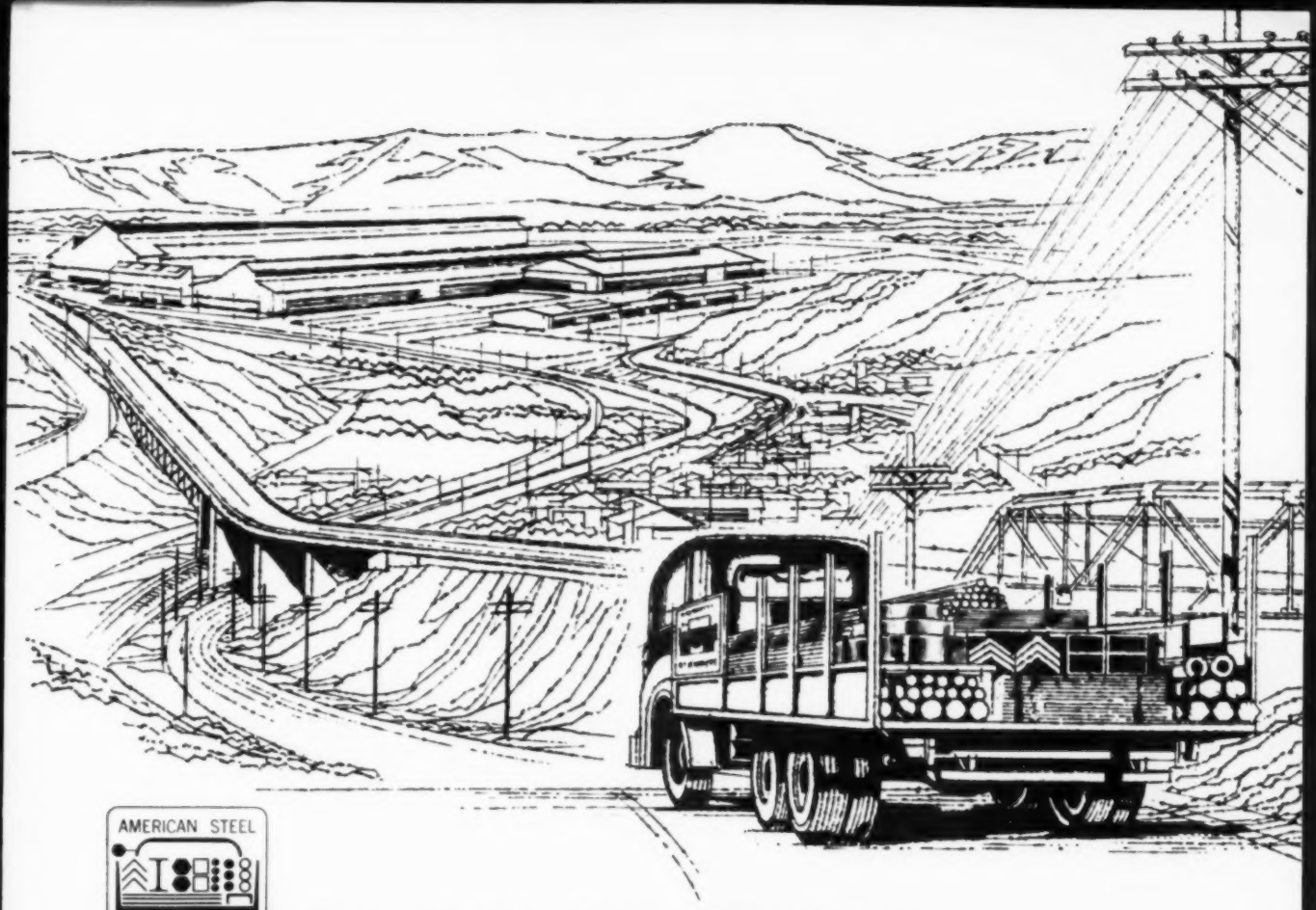
Thermal Expansion Compensation—The inherent accuracy of these machines is protected by a unique thermal expansion compensating device—built-in to the supporting bracket. Dissipation of heat from the gear box and drive motor provides additional thermal stability.

Write For Additional Information

COSA

Importers of Leading Precision Machine Tools
Nationwide Sales and Service
COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA contact **COSA CORPORATION OF CANADA, LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario**



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Symbol for Savings

In back of this symbol is a unified campaign to make every steel service center more efficient and more productive, for you. Today's **Modern** Steel Service Center enables you to:

REDUCE CAPITAL EXPENDITURES

You can operate with realistic inventories, freeing capital for more profitable purposes.

REDUCE OPERATING COSTS

Stacking, sorting, storing, cutting—every operation on a piece of steel adds to operating costs. Modern Steel Service Centers eliminate many pre-production services, and do the needed ones economically because their equipment and specialized manpower are used full time.

REDUCE OVERHEAD COSTS

Obsolescence, taxes, insurance, accounting, rent, heat, light – all overhead items which are too easily forgotten although they add to production costs. Modern Steel Service Centers eliminate these costs to you.

Using a Modern Steel Service Center is Like Adding a Money-Making Department to Your Plant

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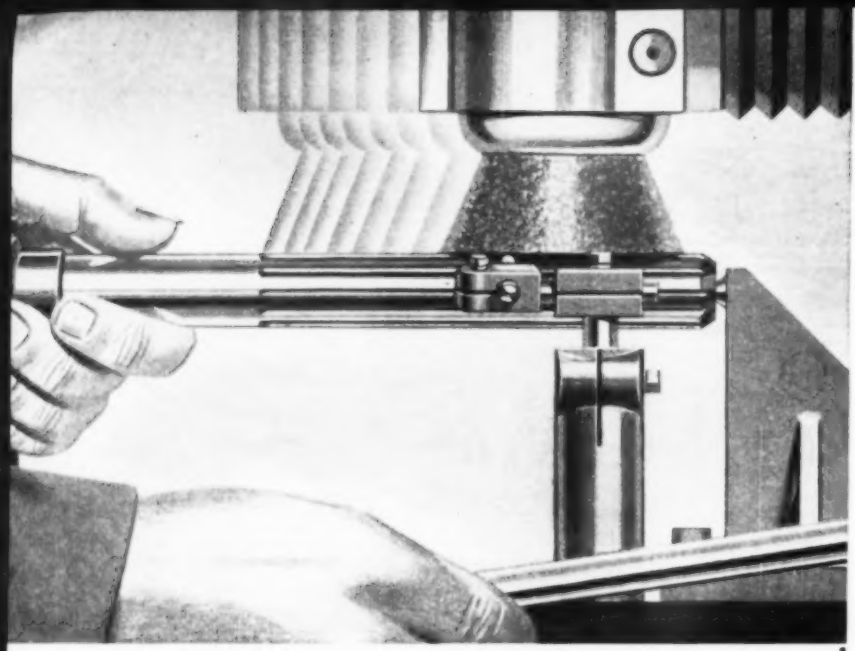
CIRCLE 269 READER SERVICE CARD



OLIVER "ACE" TOOL AND CUTTER GRINDER

Traverses the wheel—not the work!

You can grind tools and cutters more accurately with the Oliver "ACE" because the wheel is brought to the work, reversing the usual process. Abrasive dirt and grit cannot cause wear because the cross carriage is not in motion. The horizontal ram which supports the grinding head is fully enclosed—sealed against dust and dirt. Further accuracy is assured because the wheel is trued by a stationary diamond which provides a fixed grinding line. It is not necessary to reset the cutter to compensate for wheel wear.

The "ACE" is a tool and cutter grinder designed expressly for tool grinding—not a general purpose machine adapted to tool room work. It is simple to set up. All angles are obtained by direct reading. Operators stand in a natural position with the control lever in easy reach and the work in direct view.

Face mills, reamers, end mills, staggered tooth cutters, slab mills, spot facers—all cutters straight or spiral—are quickly, easily and economically sharpened with the Oliver "ACE". Both standard and heavy duty models are extensively used for sharpening carbide-tipped circular wood saws used in both woodworking and metalworking.

Write today for complete information. We'd appreciate the opportunity of sending a quotation.

OLIVER of ADRIAN

1414 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

(Advertisement)

HOW TO REDUCE YOUR CUTTING TOOL COSTS

Three elements are absolutely necessary if there is to be a substantial reduction in cutting tool costs—the right tool, the right geometry of grind on that tool, and the right machine to produce the grind. There are various machines which will always be most suitable for specific applications. However, for the average cutter grinder jobs, Oliver has pioneered a new approach to the problem with the introduction of the "ACE" tool and cutter grinder.

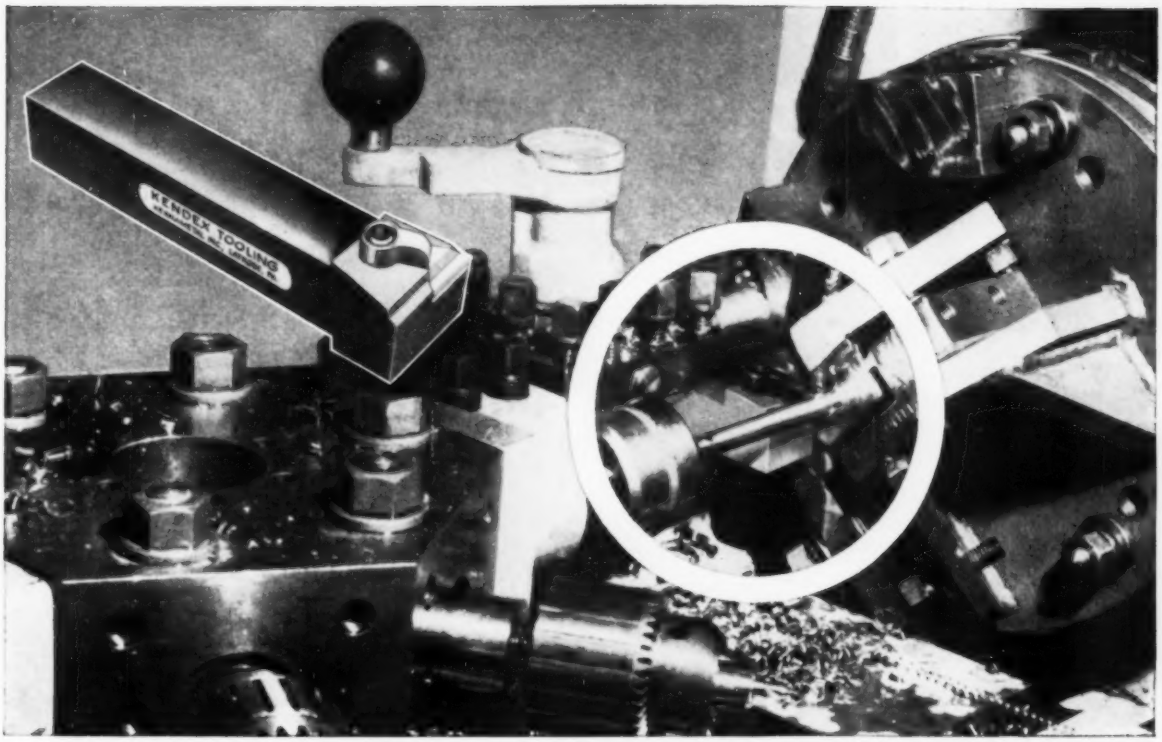
The Heavy Duty "ACE"

The cost savings are attractive with respect to both setup time and grinding time. Setup usually consists of two simple "direct-reading" adjustments. The first setting is made to produce the angular or straight line grind requirement. The second setting consists of tilting the grinding wheel spindle to produce the proper clearance—all extremely simple.

Grinding time is reduced considerably because tool travel is eliminated in most cases. Thus the time consists wholly of bringing the grinding wheel on and off the cutting tool. This compares extremely favorably with competitive grinding procedures.

This combination of easy setup and rapid grinding is found only on the economically priced Oliver "ACE" tool and cutter grinder.

There are two versions of the "ACE": the standard, which is suitable for high speed and light duty carbide grinding, and the heavy duty model which is designed for grinding tungsten carbide cutters and tools in all of their many forms.



Support bracket for Nike-Hercules guided missile, being machined with Kendex* (patented) tooling from a 316 stainless forging. Photo and performance data supplied by a leading aircraft manufacturer.

If you could cut machining cost/piece 78% wouldn't you switch to KENDEX?

That's what happened here

Two turret lathes with high speed steel tools operating on a 10-hour shift could not meet the demands of an assembly line in an aircraft plant. The job involved turning a ½-inch stud and an interrupted facing cut on a forged stainless steel part.

When one lathe was equipped with Kendex (patented) tooling and Kennametal* K8 inserts to utilize maximum output capability of the machine, production was increased fivefold and enough parts were produced by this one machine in 8 hours to keep the line running. The second lathe was released for other work.

While tooling cost per hour increased over 500%, the machining cost per piece dropped from $3.08 to 68 cents. By sacrificing a few pennies in higher tool costs, many dollars are being saved in over-all machining costs.

Progressive plants everywhere are using Kendex throw-away insert tooling on production operations and many short-run jobs to obtain highest possible machine efficiency. They have found that "babying" tools to get long tool life is a costly practice.

Ask your Kennametal Carbide Engineer how Kendex can help you get more efficient output from *your* machines . . . or write direct for the booklet, "There's Profit in Retiring a Tradition." KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

97088

Don't waste dollars **in machine output**

to save pennies in tool life

	640-minute tool life	125-minute tool life
Machine cost per hour	$ 6.00	$ 6.00
Tool cost per hour	.16	.86
Combined cost—8 hours	$49.28	$54.88
Pieces produced—8 hours	16	80
COST PER PIECE	$ 3.08	$ .68

INDUSTRY AND KENNAMETAL

...Partners in Progress

CIRCLE 271 READER SERVICE CARD

Webber MICRO-ACCURATE OPTICAL HEIGHT GAGE

measures to millionths ... *in seconds!*

Combines the two proven principles of precision measurement—WEBBER Gage Blocks and the Leitz Measuring Microscope.

The revolutionary Webber Optical Height Gage enables the precision manufacturer to meet accuracy specifications within ± .000005" per inch of height. It saves time, speeds production, reduces errors, insures peace of mind. Requires no servicing — there is nothing to wear out.

Please write for descriptive literature.

Webber 37" Height Gage Illustrated also available in 25", 49" and 61" sizes.

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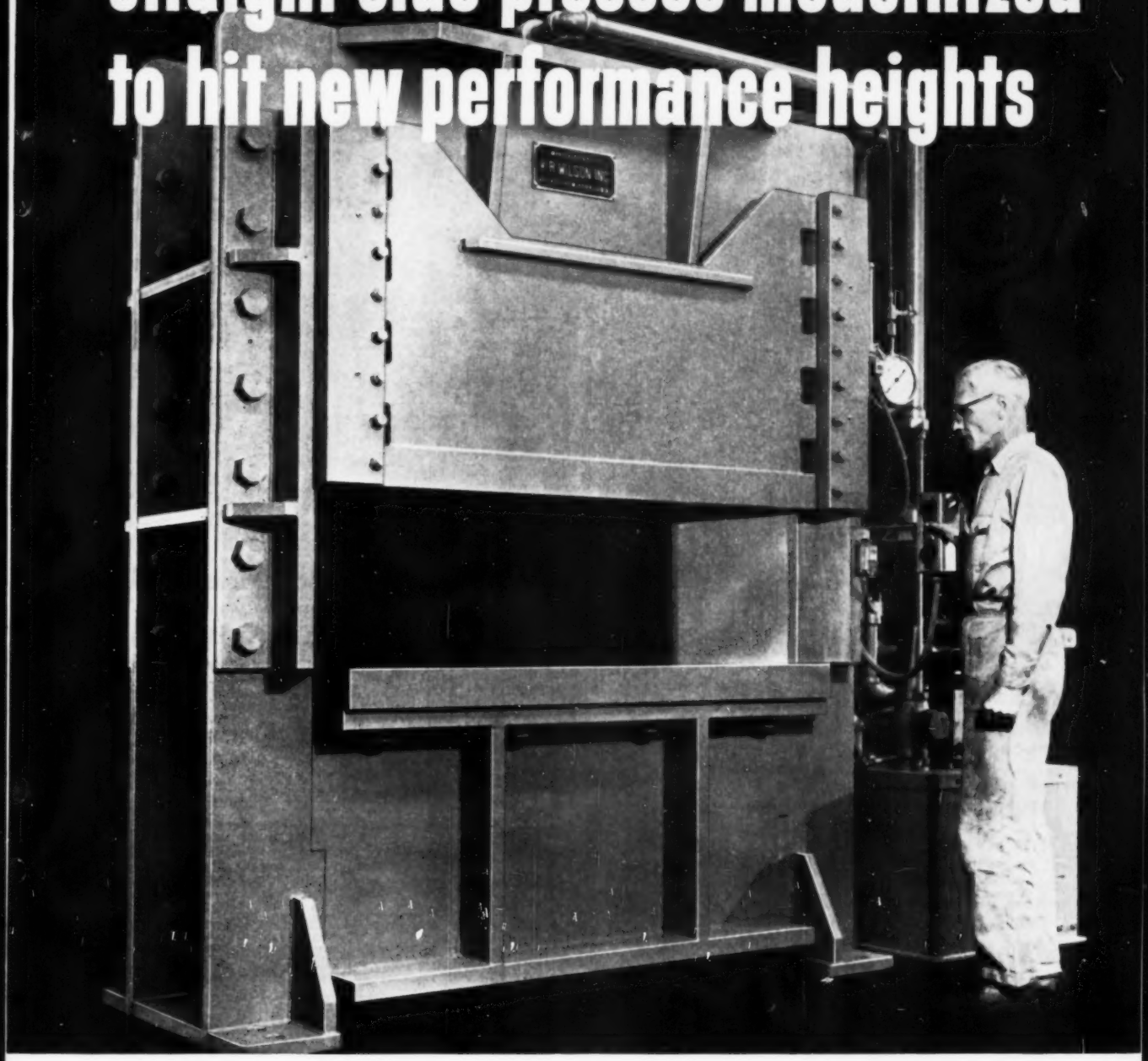
LARGEST EXCLUSIVE MANUFACTURERS OF GAGE BLOCKS

straight side presses modernized to hit new performance heights



Here's smooth hydraulic action at its best! Newly modernized, the KRW 25-1000 ton line of straight side, single action presses offers you the most profitable answer to a wide range of work: bending, forming, blanking, briquetting, broaching, coining, embossing, forging, straightening and trimming.

Boasting clean-cut, neat exteriors, these versatile machines have been engineered to improve productivity . . . *quantity-wise, quality-wise and dollar-wise!*

KRW's rugged, welded frame construction is unequalled for strength and rigidity. Members are keyed and fitted together to insure precision performance. Angle gibs, located at each corner of the sliding platen, maintain platen-to-bed parallelism to make utmost accuracy and longer die life a certainty.

Available with either up-acting or down-acting platens, KRW Straight Side, Single Action Presses can be outfitted with manual lever or electric push buttons for single or continuous cycling. Compact, easy-to-adjust and fully responsive, KRW hydraulic systems assure instant, complete press control.

More detailed information (including specs) can be obtained by writing for illustrated Bulletin 5-B. K. R. Wilson, Inc., 212 Main St., Arcade, N. Y.

KRW HYDRAULIC PRESSES

CIRCLE 273 READER SERVICE CARD

Photo taken at Danly Machine Specialties, Inc., showing Kerns SCF-2687 cutting fluid in use.
What makes a good Cutting Fluid?

HERE'S A TYPICAL REPORT . . .

SOURCE—Danly Machine Specialties, Inc.

PRODUCT—Kerns SCF-2687 (Medium duty Soluble Cutting Fluid, a lighter version of Kerns SCF-3207* heavy duty fluid).

ECONOMY—Big savings in lack of down-time necessary to replace fluid.

LIFE—Typical at Danly—400 gal. tank on G&L-570-FCS Horizontal Mill changed only twice since October 1957.

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ODOR—None at all in its natural state.

ANTI-WELD—No problem with build-up of chips.

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IRRITATING EFFECTS—None

NOTE: *Kerns SCF-3207 is a heavy duty soluble cutting fluid and is the only soluble that will do 99%, of the jobs that a heavy sulfurized cutting oil will do.

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Subsidiary Plant **KERNS PACIFIC CORPORATION**
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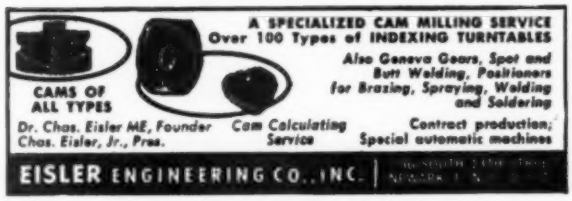
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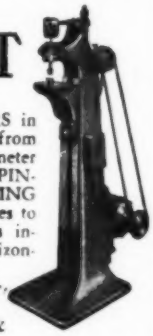

CIRCLE 277 READER SERVICE CARD

SEARCHLIGHT SECTION

ADVERTISERS' INDEX AND BUYERS' REFERENCE

Listed below are used, surplus new and rebuilt machine tools or services as advertised in this section.

The numbers after the advertiser's name, indicates the products or services offered by the advertiser.

2. Automatics
6. Boring Mills
7. Broaching Machines
10. Chucking Machines
16. Drilling & Reaming Machines
23. Gear Cutting Machines
24. Grinding Machines
29. Lathes
33. Milling Machines
37. Planers
40. Press Brakes
41. Presses
50. Shapers
51. Shears
54. Steel Mill Equipment
55. Thread Grinders
58. Welding Equipment

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"No Cost or Obligation"

This service is aimed at helping you, the reader of "SEARCHLIGHT," to locate rebuilt and used machine tools and equipment, not currently advertised. (This service is for USER-BUYERS only.) No charge or obligation.

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Cimco

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No. 410 W.F. & John Barnes, Horizontal Boring, & Drilling Machine, m.d.
No. 410 Barnes Single Spindle Deep Hole, m.d.
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2 spindle No. 6 Colburn Manufacturing Type H.D., separate m.d. to su. spindle
3 spindle 28" Cincinnati-Bickford Upright Drill, m.d., No. 4 M.T.
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No. 25 Foote-Burt, m.d., H.D.
No. 150 Baker H.D. Single Spindle, v belt drive, m.d.
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No. 7 Fellows, 1945
No. 7, 7A Fellows Gear Shaper, belted m.d.
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No. 645Y Fellows, m.d.
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W. C. Lipe Gear [illegible]

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Type S Barber-Colman, m.d.
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*2-3 Warner & Swasey, 2½" Bar Feed, RBG $ 5,500
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OR . . . something you don't want— that other readers can use—
Advertise it in the
SEARCHLIGHT SECTION

INDEX TO ADVERTISERS

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BIG TWIN combination ac-dc welders work from single phase service — deliver new convenience and economy. Two a-c amperage ranges of 20-125 and 60-290 plus two d-c ranges of 18-100 and 65-290 amps master nearly every welding requirement from light gauge metal to structural pieces. Movable shunt type transformer affords infinite current adjustments. Other features include: Horizontal design for easy stacking; weather-resistant construction and Class B insulation; Miller-built semi-metallic rectifier for best d-c welding; high open circuit voltages and new weld stabilizer. This is THE all-time, all-around welder!

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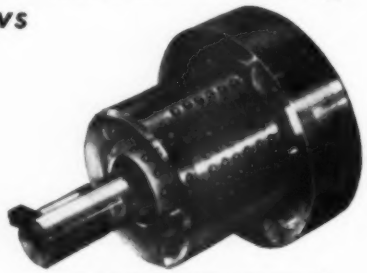

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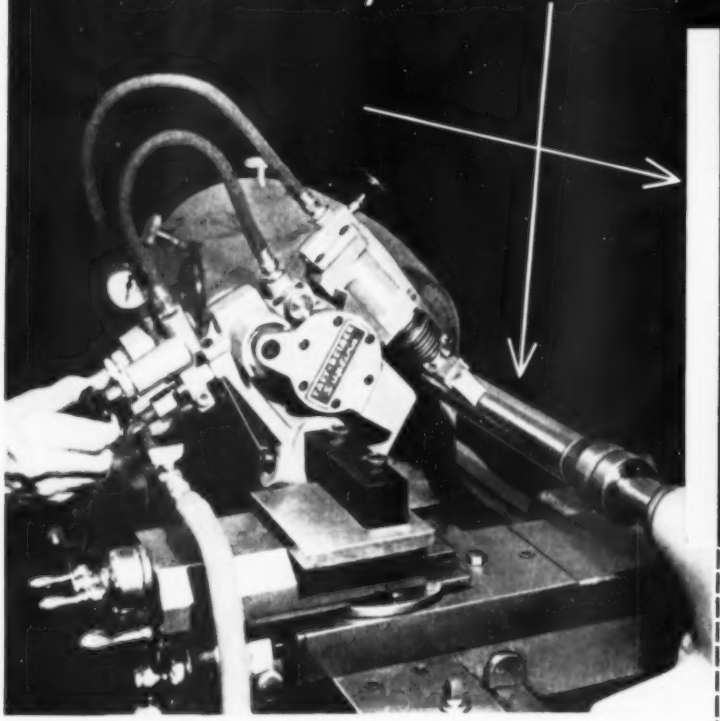

This dramatic "before and after" evidence on a Talyrond chart shows how Microstoning corrected the surface geometry of a die set guide pin. The outside trace shows an average roundness of .00028" as ground. After Microstoning (inside trace), the roundness was improved to an average of .000030". Each scale division is .000020".

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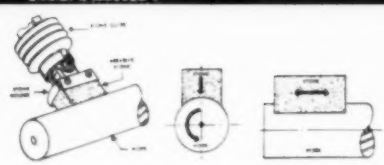

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Microstoning is a low-pressure, low temperature abrading process using stones of various grit sizes. Stones are placed against the work with light pressure and vibrated from 1900 to 2500 times a minute as the workpiece rotates. The stones shape themselves to the mean radius of curvature, and more pressure is applied at high spots. This produces a fast and simplified correction of surface geometry that is demonstrated graphically by the Talyrond chart above.

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